The Blast Furnace and Steel Plant

Editor—**FRED J. CROLIUS**

EDITORIAL ADVISORY BOARD
THEODORE E. SEE, DR. J. S. UNGER, BARTON R. SHOVER, KENNETH B. LEWIS
F. E. KLING, E. H. McCLELLAND, DONALD N. WATKINS

Volume XIII | AUGUST, 1925 | Number 8

CONTENTS

Page
EDITORIAL—PULL AND PUSH ... 309
BILLETS TO BRIDGE—By F. J. Crolius ... 310

CURRENT REVIEW—

NEW COKE-OVEN TYPES, Part II—By O. Peischer ... 314
THE AMERICAN VERSION—By F. W. Sperr ... 317
CURRENT LITERATURE ON FERROUS METALLURGY—By E. H. McClelland ... 319
FOREIGN TRADE AND INTERNATIONAL STABILITY—By Edmund A. Walsh ... 320
ABSTRACTS OF INDUSTRIAL AND ENGINEERING CHEMISTRY ... 322

THE SAFETY CRUSADE—

ORE AND COAL BRIDGES MADE SAFE—By W. G. Hildebran ... 323
THE DEVELOPMENT OF THE RECUPERATOR—By E. R. Posnack ... 327

THE POWER PLANT—

BOILER FURNACES FOR PULVERIZED COAL—By H. W. Brooks ... 330

SHEET AND TIN PLATE—

SPALLING OF SHEET AND TIN PLATE ROLLS—By Harold Harris ... 334
THE PLANT LABORATORY AND THE TESTING OF RAW MATERIAL—By S. R. Robinson ... 336
WITH THE EQUIPMENT MANUFACTURERS ... 338
BY-PRODUCT AND CHEMICAL NEWS ... 339
TRADE NOTES AND PUBLICATIONS ... 340
THE OPEN HEARTH ... 341
NEWS OF THE PLANTS ... 342

Published the first of each month by The Andresen Company Inc.
Main Office—Thaw Building, 108 Smithfield Street, Pittsburgh, Pa.

President: L. L. CARSON   Vice President: GEO. A. ERB   Secretary and Treasurer: M. M. ZEDER

Branch Managers

JONES & SALE, Western Representatives
1014 Garrick Theatre Bldg.
Phone—State 4357
Chicago, Ill.

ROBERT E. POWELL, Eastern Manager
29 West Thirty-fourth Street
Phone—Wisconsin 5495
New York, N. Y.

Subscription Price:—In the United States, $2 per year; Canada, $2.50; all other countries, $3.50. Single Copy, 25 cents.
Entered as second-class mail matter at Pittsburgh, Pa., under the Act of Congress, March 3, 1879.

The Blast Furnace and Steel Plant

Vol. XIII PITTSBURGH, PA., AUGUST, 1925 No. 8.

Pull and Push

ONCE in a while a man gets a good job through a pull with the big boss. But this does not happen half so often as some suppose. ¶ The surest way to get a better job is to learn all there is to know about your own job, and then start in to learn all there is to know about the better job which you would like to have. There are men in our company and in every company who have got to the top by this very process.

The best example of learning the next job ahead is found in the sheet mill where the matcher and doubler and catcher and rougher, if they are anxious to get ahead, are constantly slipping over and doing part of a heat or a whole one for the man just ahead. This is the way rollers are made.

But if the matcher, or doubler, or catcher, or rougher is afraid that he will do a little work without getting paid for it, he is likely never to become a roller, for there isn't any other way to become one.

One reason why some men do not get ahead faster is that they do not know what happens to the iron, either before or after they have done their particular stunt with it. If the iron goes bad on their hands, they may not know whether it is their own fault, or the fault of some one earlier in the process. If sheets are rejected by the inspector, they do not know, nor seem to care, where the cause of rejection arose.

If any ambitious Armco man anywhere along the line between the open hearth and the shipping department would come out a little early and spend a few half-hours a week in other departments, watching what happens to the material there, there would be two possible results. First, it would greatly improve Armco products and processes; and, second, it would greatly improve the chances for advancement of the man who would thus invest a part of his spare time.—American Rolling Mill Company Bulletin.

Billet to Bridge

The Philadelphia-Camden Bridge Approaches Completion—Next Fourth of July Will Witness Its Opening

By **FRED J. CROLIUS**

THE world's longest and most impressive suspension bridge is now nearing completion. Ferry passengers across the Delaware River have watched with growing interest, almost with awe, the gradual growth of this engineering and architectural colossus.

It spans the river at a height of 137 feet, slightly higher than any other of our familiar suspension bridges. The over-all length of the Camden bridge is nearly two miles, including the approaches, while the actual distance between the steel towers is 1,750 feet.

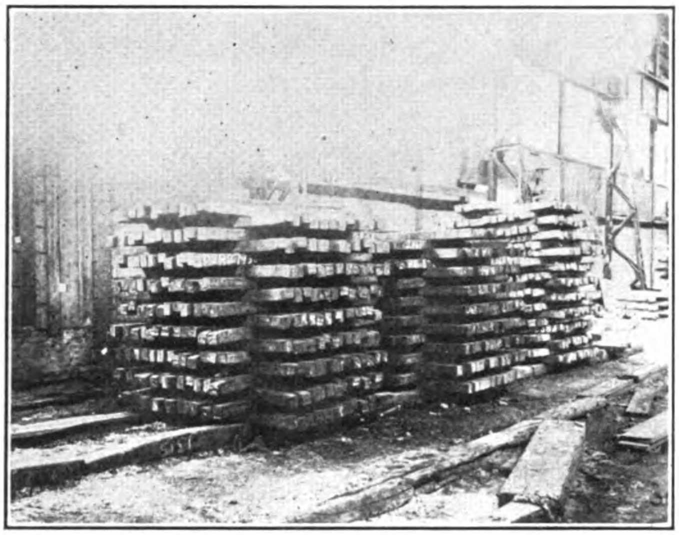


FIG. 6.—*Piles of 4 in. x 4 in. steel billets at the Monessen Plant of Page Steel & Wire Company, piled, tested and numbered, ready for their journey through the heating furnace and mills and wire drawing benches, to emerge in the form of the strongest wire ever made.*

The anchorages of the bridge weigh more than 400,000 tons, calculated as over 20 times the total load the cables will ever have to sustain. The two anchorages contain over 300,000 cubic yards of concrete, solid masonry, and the balance of the total weight is made up of the granite facing, which will carry the carved embellishments, such as the arms of the states of Pennsylvania and New Jersey, and of the cities of Philadelphia and Camden.

Rising upon these massive anchorages are the structural steel towers, 385 feet in height, and from this height, as a point of suspension, can be seen the suspending cables. In these cables, 30 inches each in diameter, are encased 18,666 galvanized cable wires; the total length of the cable proper is 3,550 feet, while the total of all the wire in these cables exceeds 25,000 miles. Surely an achievement for any organization and a heavy responsibility for the engineering organization who created it and carrying it to a permanent conclusion.

These main cables weigh approximately one ton per lineal foot, and are calculated to carry a maximum load of 60,000 tons, 70 per cent of which will represent the weight of the bridge itself, and 30 per cent the weight of the traffic. Traffic will be divided between four main railway tracks, a 57-foot roadway and two 10-foot footways.

The actual "out in front" construction of such a bridge is always interesting, but seldom does the average onlooker give a thought to the important arrangements necessary to make this work possible. It is impossible to overestimate the detailed care in the bridge engineering drafting rooms, and the fabricating shops. As the construction engineers bolt together in the bridge center, ready for permanent riveting, the two structural ends, which have been assembled separately, starting from both towers, that simple joining is silent proof of the accuracy of engineering calculations. An unexpected development during erection emphasized this.

Early in June, one of the main towers was found to be leaning. When the work of placing the roadway steel began, four separate crews of workers were employed. One crew worked outward from the Camden tower toward the center of the river, and another crew worked similarly from the Philadelphia tower; these were the main span erectors.

On the spaces which separate the towers from the anchorages, known as the side spans, one crew worked from each tower toward the shore. Upon the relative speeds with which these crews progressed depended the "balance of the structure."

Work on the river side of the Philadelphia tower proceeded faster than on the Camden side and the Camden tower developed a lean of more than 12 inches.

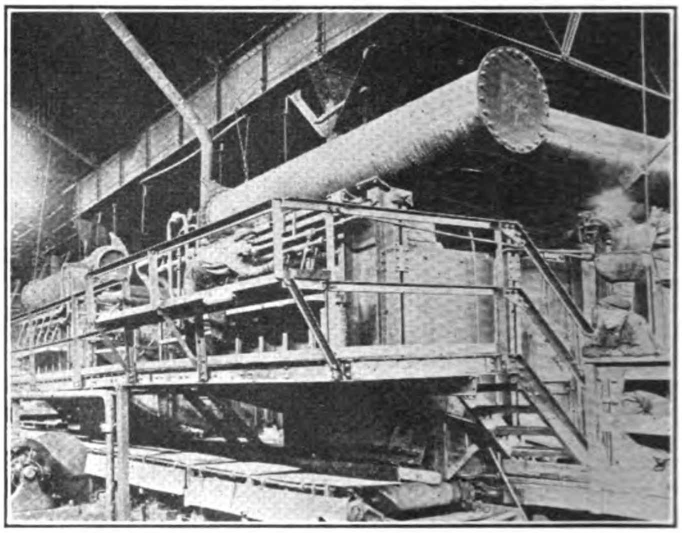


FIG. 3.—*An elevation of the continuous billet heating furnace, where the billets are continuously brought to the exact temperature for rolling. Note in the lower foreground, a white hot billet emerging onto the roll train ready to enter the mill.*

Construction work was then concentrated upon the unbalanced sections, and as the equilibrium of load was again re-established the tower assumed its normal position, and the work of joining proceeded as per schedule.

As the main elements of a suspension bridge are the main cables, the details of construction are always of interest.

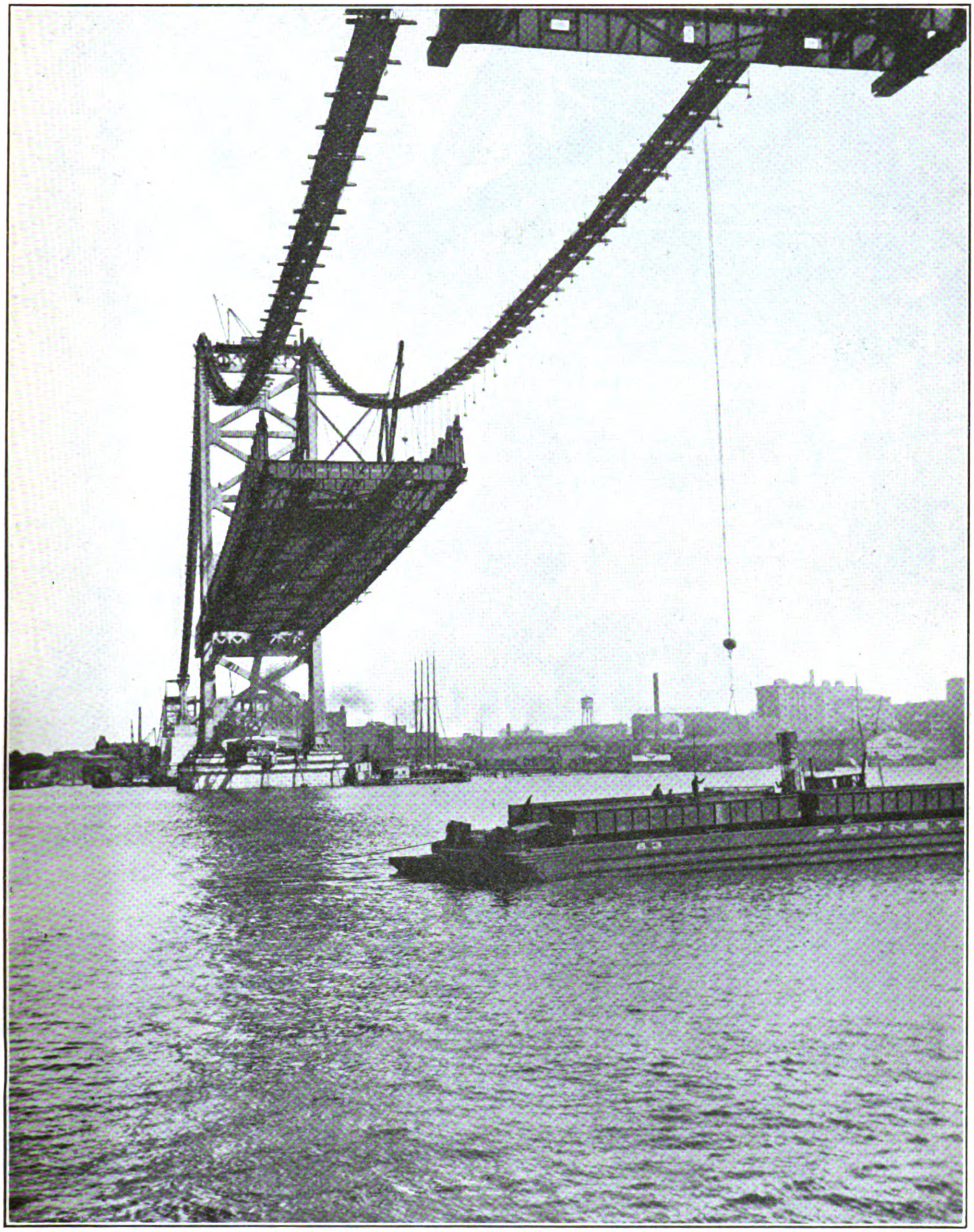


FIG. 1.—*An unusual view of the new suspension bridge across the Delaware River, showing the structural supports of the main* ***roadway.*** *Above are clearly shown the huge cables, and below a lighter from which the working materials are hoisted.*

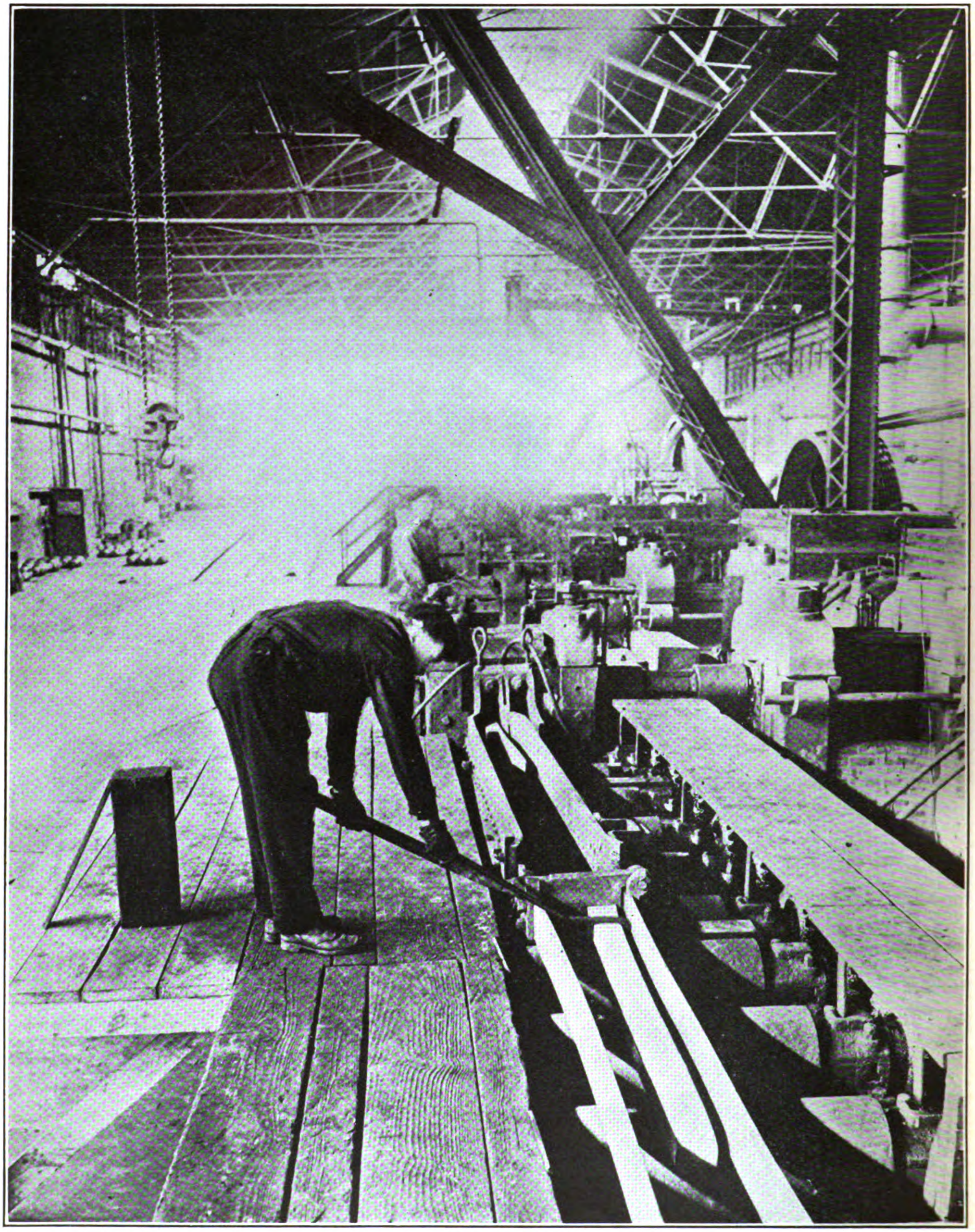


FIG. 4.—*The billets entering the first pass of the rod mill; rolled gradually down to rods, which then pass through various reductions and processes until cold-drawn into wire of the specified dimension.*

Fig. 1 shows an excellent view of these main cables taken at a time when only part of the roadway steel was in place; the cables can be seen with their dependent eye-bars.

Fig. 2 shows the origin of the cables; piles of 4x4-in. billets piled, tested and heat numbered, ready for their journey through the mills and draw-benches, where the billets are converted into wire.

Fig. 3 shows a typical continuous billet heating furnace at the Monessen plant of the Page Steel & Wire Company, which plant made the wires used in these cables.

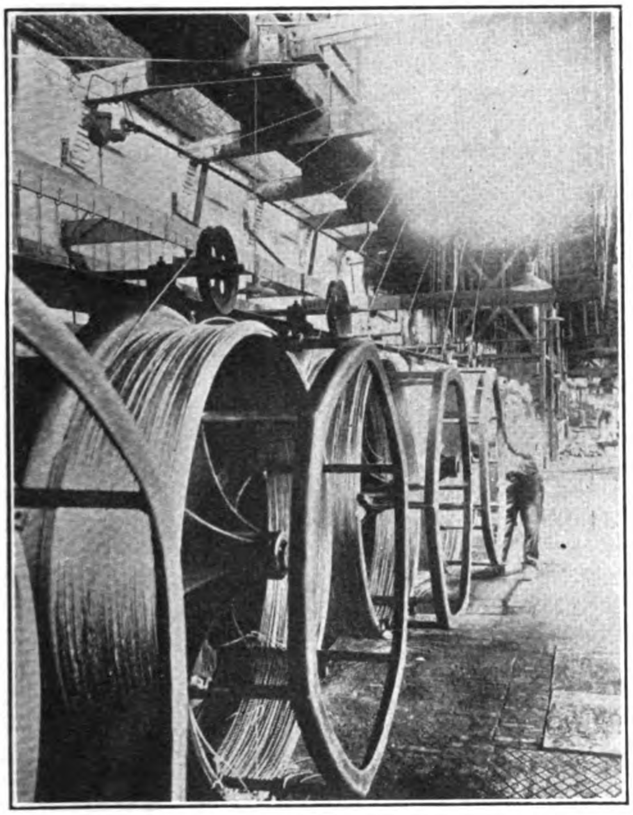


FIG. 5.—*A line of take-up frames. After the wire has passed through the spelter bath of the galvanizing unit it is allowed to air-cool, and is then wound on these large reels. New Jersey Zinc Company metal was used in the galvanizing process.*

Fig. 4 shows the billets entering the rod mill, where the various reductions bring the rod down to the correct wire size. This cable wire possesses a tensile strength of 223,000 lbs. per square inch of cross section.

Fig. 5 shows the take-up frames at Monessen, and reels upon which these 37,332 wires are wound.

As a fitting climax, it is planned to open the Delaware bridge on the Fourth of July, 1926, during the observance of Philadelphia's one hundred and fiftieth anniversary.

Trade Associations Legal

Organizing the units of an industry into a trade association to deal with its common problems is both legal and desirable, declared E. W. McCullough, manager of the Department of Manufacture of the United States in an address at Detroit before the Society of Brass Manufacturers.

"Moreover," he continued, "recent decisions of the United States Supreme Court have made it clear that information vital to the industry may be gathered and passed on by the association to its members and made available to the public without governmental interference, provided that, at all times, such information is not used in any way as a vehicle for price-fixing or curtailing production."

Mr. McCullough went on to say that "the largest units in industry have their organization and equipment for gathering factual information useful for intelligent management. The smaller units, unable to finance individually the gathering of similar information, if we construe the recent Supreme Court decisions correctly, may organize an association and set up within such organization machinery for rendering a like service and without contravention of law."

"After a trial of more than a half century," he said, "the trade association has proven its worth as a medium for service to the members of an industry who, although they continue their relations as competitors, yet work together co-operatively in dealing with non-competitive problems which come before them from time to time.

"Among the studies which have profited such associations most are those relating to research, scientific and general, simplification and standardization, cost accounting, setting up qualified standards, arbitrating differences, setting up of codes of recognized trade practices, the establishment of technical schools, etc. In other words, those problems the study of which is valuable as information to the industry and the solution of trade questions, marks advancement.

"Trade associations in their early beginnings were largely organized for defensive or offensive purposes—a sort of protective agency—while today the objectives of the modern trade association are largely, if not all together, for the enlightenment and progress of the industry rather than for direct personal benefit of its members.

"The Chamber of Commerce of the United States, whose constituent membership represents so large a percentage of trade associations, has continually given attention to the problems and the progress of these associations and has rendered most valuable aid in working the Government for a better undertaking as to what they might or might not do.

This Chamber of Commerce movement which has so thoroughly taken root as a typical American institution, has resulted in such a very wide correlation of incident activities as to defy appraisal. The support of this body by any desirable organization is almost a guarantee of success.

"In the referendum of the chamber on trade association activities it frankly placed before the business organizations of the country eight questions relating to vital issues and received the unanimous endorsement of the position taken concerning them. This position has been confirmed as correct in the Supreme Court decisions recently delivered."

"It is well to keep in mind," Mr. McCullough suggests, "that the decisions referred to change no laws and give no greater liberty to associations than before, but they do make clear the fact that many activities in which trade associations generally desire to engage are not in themselves under ban of law and if they are used intelligently and for the common good and not to create restraints in trade, there will be no interference with them."

CURRENT REVIEW

New Coke-Oven Types[*]

Carbonizing Capacity, Temperature Distribution and Heat Consumption

By DR. ING. OSWALD PEISCHER[†]

PART II

WITH the reduction of the chamber width and with the recognition of the importance of discharging the chambers at the right moment after complete carbonization of the charge, increased importance was attached to uniformity of heating. Owing to the absence of all heat compensation through over-distillation in the chambers, inequalities in the heating are immediately recognizable by the dark or light patches in the coke cake.

Chambers not vertically tapered, such as were exclusively constructed up to the year 1917, tend to become hotter below than at the top. This is natural, since the highest combustion temperature and therefore also the strongest transmission of heat are obtained at the point where gas and air meet. This applies all the more, the higher the initial temperature is, in the case of coal gas having a high heating value, therefore, much more than in the case of poor gases—producer gas or blast furnace gas. In chambers with parallel walls, therefore, a retardation in the carbonization of the upper portions of the coke cake will always be found, so that when determining the carbonizing period in accordance with the state of the upper portions those nearer to the bottom of the chamber become overheated. By measuring the temperature curves at different heights in the center of the chamber by means of thermo-electric couples, the fact may be established that the upper portion of the cake often requires another two hours, or even more, to reach the temperature of the lower portion. Once it was recognized that overheating resulted in difficult combustion of the coke, and since the requirements in respect of uniformity in the properties of the coke from one oven became even more stringent, coke oven constructors turned their attention also to this question.

Koppers solved the problem by utilizing the experience gained which showed that by shortening the heat path the speed of coking was increasingly enhanced. He made the chambers narrower at the top than at the bottom, that is he tapered them off in the vertical direction. Since, according to experience, the coking speed increases very rapidly with the reduction of the width of the chamber, a relatively slight taper suffices to ensure simultaneous carbonization at all levels in the charge despite the fact that the wall temperature decreases towards the top. The first coke ovens of this type were built as far back as 1917; today there are already 1754 of these ovens in operation at coke-works in Germany and abroad. In connection with the efficiency tests with the Koppers plant at the Bahnschacht Coke Works, measurements were made in respect to the temperature curve at three different heights in the middle of the chamber on the coke side and on the pusher side. The results of these measurements show that there is only a few minutes difference in the time when the temperature at the top and bottom on the machinery side as well as on the coke side, become equal so that carbonization is obtained practically at the same time at all points of the coking mass. (Fig. 2.) Thus the purpose intended by the upward tapering is achieved in the simplest and most ingenious way.

The Koppers Company in America has sought to solve the problem of the uniformity of heating on other lines. Shortly after the war, the Koppers Company appeared on the market with a type of coke oven which shows all the fundamental features of the Koppers' type of construction and differs from it only in the method of drawing off the flue gases (Fig. 3). The horizontal flue of each heating wall is in communication with the flue of the adjacent heating wall by passages above the roof of the chamber. In the case of the original Koppers oven the flue gases alternate above the middle of the heating walls so that one half of a heating wall is always traversed by ascending gases, the other half by discharging gases, whereas in the American Koppers Oven the gases above the roof of the chamber alternate in such a manner that the whole of one heating wall is traversed by ascending the next one by discharging gases. This modification, according to Becker in the Koppers Company's publications, was necessitated by the change over to narrower chambers. For the majority of coke oven and blast furnace operators are, he states, of the opinion that especially from high volatile coals a better coke can be produced in the narrow oven. He then goes on to state: "In making the oven narrower the coking capacity per 24 hours would necessarily be reduced unless a considerable multiplication of the operations would be resorted to. The first thought would naturally be to compensate for this by building higher and longer ovens and thus increasing the tonnage per oven per 24 hours."

---

[*] Iron and Coal Trades Review, London, England.
[†] Essen, Germany.

Digitized by Google Original from UNIVERSITY OF MICHIGAN

Such was Becker's statement before the Eastern States Blast Furnace and Coke Oven Association in Buffalo, N. Y., on October 5, 1922*, at a time when the five experimental ovens of this type, at the plant of the Chicago By-Product Coke Company of Chicago, had already been in operation since February 1, 1922. This statement clearly shows that Becker as yet had not recognized or would not recognize the substantial increase in coking capacity resulting automatically, i. e., without any increase in the height and length of the chambers, from the reduction in the width of the chambers. At all events, a convincing proof of the justification of Becker's modification of the Koppers oven could only be furnished by ignoring the dominant part played by the reduced width of the chamber in enhancing the coking capacity and attributing this increase exclusively to Becker's modification. From the necessity of enhancing the coking capacity by increasing the height of the chambers, it was sought to adduce the proof that, owing to the larger quantities of gas resulting from this increase, a horizontal flue considerably larger in cross section was required than in the case of the original Koppers oven, if it is desired to avoid enormous losses in draught. This is the reason of the sub-division of the horizontal flue and the collection of the combustion gases at several passages above the roof of the oven.

It must at once be admitted that by this means the structurally troublesome horizontal flue can be reduced in size. This is certainly an advantage, which, however, as will be pointed out later, involves certain disadvantages. This modification, however, contributes in no way, not even in the slightest, to a more uniform heating. The heating flues are higher, and so the natural drop from below upwards in the flame temperature is further intensified. If in the experiments with the ovens in Chicago temperatures to some extent uniform were found in the middle of the chambers, this was no doubt mainly owing to a generally-known measure, which is also applied by the Koppers Company, but which Becker, in his publications, mentions only by the way. For if the discharge velocity is increased, for instance of the air from the air nozzle by constriction by means of an inserted piece, the diffusion velocity between gas and air will be reduced and combustion retarded, while the transmission of heat will be diminished at the lower end of the heating flues owing to the higher gas-speeds at that point; the temperatures then become more uniform towards the top.

Van Ackeren has made detailed observations as to the Becker oven in respect of firing from the technical standpoint.† No importance can be attached to his deductions, maintained with much expenditure of theory, which are intended to prove that the flue gases are better distributed and the losses in draught smaller in coke ovens with passages over the roof of the chamber. In particular, with regard to the diminished risk of short circuits between oven walls with differences in draught at both sides as claimed for the Becker oven by Becker and Van Ackeren in their publications, their statements relating thereto appear to require rectification. In the Koppers oven of the original type (Fig. 1) the middle pillar-wall **a**, and the connecting heating wall located above it, may be described as dangerous wall surfaces, since they effect the separation of the ascending and discharging sides of the oven, the total area of these surfaces is about 1.8 sq. m. per chamber. In the Becker Oven (Fig. 3) the dangerous wall surfaces are constituted by every fourth regenerator wall **b**, which separates the air side and waste heat side and has an area of around 19 sq. m. that is considerably more than in the Koppers oven of the original type. Even although leakages may only result in losses in air, such losses may be detrimental to the heating of the corresponding heating wall and cause losses in heat.

In the type of oven built by the firm Karl Still, Recklinghausen, it is sought to obtain a uniform heating in the upper section of the chamber wall by stagewise combustion of the heating gases (Fig. 4). In this type vertical passages, each having four outlets to each side of the heating flues, are provided in the connecting walls. Through these passages the combustion air is introduced at four different heights into the heating flue, while the gas flows into this flue through a nozzle on the bottom of the heating flue in the usual manner. The idea of burning the gas by stages is not novel, being already embodied in Koppers' German Patents Nos. 122790/1899 and 199103/1907. The temperature curve likely to occur in the heating wall with this method of heating is theoretically easy to trace. Assuming that four points of combustion are present, in which the same quantities of gas are burnt, that is one-fourth of the total amount of gas and air for each heating flue, then on the basis of these observations, of which, for the sake of brevity, only the results are here given, the theoretical initial temperatures and the theoretical temperatures of the gases close to the next point of combustion will be as follows:

	Theoretical initial temperatures	Theoretical temperature of the gases near the next point of combustion.
1st point of combustion	1818° C.	1245° C.
2nd point of combustion	1924° C.	1601° C.
3rd point of combustion	1970° C.	1715° C.
4th point of combustion	2000° C.	1790° C.

The temperature curve is graphically illustrated in Fig. 5. This shows that the initial temperature and the temperature of the flue gases increase more and more towards the top, which is easily understood, since the unconsumed portions of coal gas on their way to the top are continually reheated by the flue gases, so that higher initial temperatures must necessarily result. These temperatures and the calculated combustion-gas temperatures naturally apply only theoretically. The temperatures actually occurring at the various points of combustion, however, behave approximately in the same manner as the temperatures calculated theoretically, that is to say, the chamber walls become hotter at the top than at the bottom —the position has been exactly reversed by combustion in stages. By suitable dimensioning of the cross sections of the air outlets the temperatures might, perhaps, be equalized, provided the most perfect con-

---

*Joseph Becker: "Modern By-product Coking and the New Koppers Company's New Combination Oven". Published, complete or abridged, in the "Iron Trade Review, year 1922, page 1055; "*Stahl und Eisen*", year 1923, page 1479, and other Journals.

†J. Van Ackeren: "Heat Distribution in New Type Koppers Oven". Min. Metallurgy, year 1923 p. 140, *Stahl und Eisen*, 1923, p. 1479.

trol of the draught conditions in each heating flue is possible.

Compared with the method of obtaining an equalization of temperature in the top of the chamber by tapering the chamber width or by means of suitable adjustment of the gas velocities in the heating flue, Still's process appears very complicated and difficult of control.

The firm of Collin, in Dortmund, according to their German Patent 189326, heat the flues alternately from above downwards and from below upwards, the points of combustion of the introduced heating gas being located above and below respectively; the air for the upper point of combustion being admitted through open air passages in the connecting walls separating the heating flues which in the next heating period, when combustion takes place from below upwards, serve for the discharge of the flue gases. There can be no doubt that by this process a uniform heating of the heating flues may be obtained, but this advantage entails technical disadvantages in respect to firing. Difference in pressure exist between connecting passages and heating flues, owing to which the dangerous wall surfaces, which may give rise to short circuits, assume considerable importance.

Heat Consumption.

According to the results of researches hitherto carried out, the distillation of coal of geological age, such as is used in coking plants proceeds without heat consumption, that is to say the endothermic and exothermic processes are approximately in equilibrium*. Thus the heat supplied to the coke oven serves the sole purpose of bringing the coal to the distillation temperature. The heat requirements of a coke oven are divided into:

1. Gas and vapor heat.
2. Coke heat.
3. Radiation and conduction.
4. Loss by waste-heat.

Among these quotas of heat expenditure the gas heat is a constant quota which can scarcely be influenced. Of the coke heat the amount lost in the quenching operation is all the greater the wider the chambers are, for with the width the temperature prevailing in the outer layers of coke which is required to conduct the heat up to the center also increases. Furthermore, the coke heat assumes unprofitably high proportions if the heat is not uniform, viz., for the purpose of completely carbonizing slightly heated portions, strongly heated portions have to be overheated. The item in heat expenditure most easily influenced is that due to radiation and conduction. This item can be substantially reduced by effective heat protection of the oven as well as by the use of narrow chambers, since, as shown above, with the same oven dimensions a considerable increase in coking capacity is obtained with narrow chambers, so that the heat expenditure in respect of radiation and conduction is reduced in the same proportion. The influence of the different coking capacity of the ovens in two plants of the same type may be traced mathematically as stated below:

Taking 1 kilo of coked coal:

W_1, W_2 indicate total heat expenditure.

st_1, st_2 indicate heat expenditure in radiation and conduction.

g_1, g_2 indicate gas heat.

k_1, k_2 indicate coke heat.

a_1, a_2 indicate loss by waste heat.

Then, generally,

$$w = st + g + k + a$$
$$st + g + k = q$$

q may be described as the effective heat consumption, since, in contradistinction to the loss by waste heat, it is absorbed by the oven. The waste-heat loss is proportional to the total heat expenditure w.

Therefore $a = w \cdot n$,

in which n is a factor which represents the heat consumption in the waste gases per unit of the heat supplied to the oven and which, for a given oven system, may be regarded as a constant*. From the foregoing it is seen that:

$$w_1 = q_1 + w_1 \cdot n, \quad w_1 = \frac{q_1}{1 - n}, \quad w_2 = \frac{q_2}{1 - n}$$

$\frac{w_2}{w_1} = \frac{q_2}{q_1}$, i.e., the total amounts of heat to be used in two plants behave as the effective amounts of heat.

The equation may also be written as follows:

$$\frac{w_2}{w_1} = \frac{st_2 + k_2 + g_2}{st_1 + k_1 + g_1}$$

A simple consideration, which may be easily tested mathematically, now shows that in two plants of the same type and having surfaces of the same extent, but with different width of chambers and therefore different coking capacity, the specific expenditure in coke heat and gas heat will be approximately the same, whereas the specific loss in radiation in the plant with narrow chambers becomes smaller in proportion as its coking capacity is increased. Thus, if L_1 and L_2 respectively indicate the coking capacity of these plants, then:

$$\frac{w_2}{w_1} = \frac{\frac{L_1}{L_2} \cdot st + k_1 + g_1}{st + k_1 + g_1} \qquad 3$$

Applying this equation to the foregoing example of two plants, one with chambers 50 mm. in width, the other with chambers 350 mm. wide, it is found that:

With chambers 500 mm. in width and having parallel walls 600 to 650 Cal. per kilo of coal with 10 per cent of water, are guaranteed and are in fact obtained. In this total heat expenditure the items are approximately as follows:

	Cal.
Gas and vapor heat	137
Coke heat	137
Radiation and conduction	209
Loss by waste heat	91
	624

---

*J. D. Davis and Palmer B. Place: "Thermal Reactions of Coal During Carbonization", *Fuel*, year 1924, p. 434.

*With a waste heat temperature of t deg. C. a net gas calorific value H per cubic m., a mean specific heat cp. of the waste gases per cubic m. and a waste heat volume v from 1 cubic m. coal gas will give: $n = (v.cp.t. \div H)$.

The calculation of coking capacity for both plants showed a ratio between the outputs of

$$\frac{L_1}{L_2} = \frac{1}{1.644} = 0.608$$

With the use of equation 3, we then get $\frac{w_2}{w_1} = 0.846$, that is to say if in the plant with chambers 500 mm. in width the heat expenditure per 1 kilo of wet coal is 624 cal., in the plant with chambers 350 mm. in width the amount is reduced to about 528 cal. Thus, with the increased coking capacity the specific loss by radiation is diminished, as the total expenditure for radiation and conduction per 24 hours is distributed over a large quantity of coal, while the specific consumption in gas heat and coke heat remain about the same. With regard to the coke heat, certainly, this is only approximately correct, for, as already stated, the losses in heat in the coke are larger with wide chambers than with narrow chambers. Moreover, the uniformity of heating has also an influence on the losses in heat in the coke. In practice, therefore, the heat consumption of an oven slightly tapered towards the top and with chambers 350 mm. in width will still be less than 528 cal. per kilo of wet coal.

This fact has also been established during the efficiency tests at the three Koppers plants, viz. at the Coke Works of the Thyssen Blast Furnace and Steel Works in Hamborn, the Consolidation Mining Company's Coke Works in Gelsenkirchen, and the Bahnschacht Coke Works in Waldenburg. The results of the tests and the essential measurements of these plants are shown by Table No. 1. It was found that the heat consumption per kilo of wet coal in the two plants of 400 mm. in width at the Thyssen Works and the Consolidation Works was 492 cal. and 495 cal. respectively; at the Bahnschacht plant, with chambers 350 mm. in width, it was only 480 cal. In respect to dry coal the lowest heat consumption was reached at the last named plant, i.e., 422 cal.

Such exceptionally low heat — consumption figures of course have been established and repeatedly verified in taking all the necessary precautions when carrying out the measurements during the tests. However improbable such low heat consumption may appear in comparison with the usual heat expenditure for the wide-chambered oven, it may be readily explained with the aid of the foregoing statements.

Summary.

We see that since about the year 1917 the art of coke-oven construction has made very considerable progress. Economic results were obtained in coking work on a scale that could not have been foreseen. If we enquire as to the constructive measures which gave rise to them, we find that the narrow chamber type, such as was first introduced by Koppers and which has been repeatedly held up as a model to be aimed at is the principal factor in these results. From the standpoint of effect, the heating, which has been brought to practical perfection, and the uniformity of heating thereby obtained, take a secondary place.

TABLE I.

RESULTS FROM NEW KOPPERS PLANTS

Plant:	Coke works of the Friedrich Thyssen Mining Company in Hamborn Bruckhausen Colliery	Coke works of the Consoidation Mining Company, Gelsenkirchen	Coke works of the Prince Pless Mining Administration in Waldenburg Bahnschacht Colliery
Date of starting....	Batt. II Sept. 22 Batt. III Feb. 24	July 1924	May 1924
Number of ovens...	2 x 65	50	30
Kind of heating....	Poor gas or rich gas	Poor gas or rich gas	Rich gas
Mean width of chamber	400 mm.	400 mm.	350 mm.
Ovens discharged daily	2 x 88	66	60
Moisture in coal....	12.3%	9.8%	10%
Net coking time....	17¼ hrs.	17½ hrs.	11½-11¾ hrs.
Gross coking time..	17¾ hrs.	18 hrs.	12 hrs.
Coal carbonized per chamber per 24 hrs........	15.4 tons	14.5 tons	16.6 tons
Coal carbonized in plant per 24 hours	2 x 1000 t.	725 tons	500 tons
Heat consumption per kilo of wet coal	492 Cal.	495 Cal.	480 Cal.
Heat consumption per kilo of dry coal	429 Cal.	440 Cal.	422 Cal.

The American Version

A Criticism of This Foreign Viewpoint by One Thoroughly Qualified to Speak

By F. W. SPERR

IN the paper "New Coke Oven Types" which appears in July and August issues, Dr. O. Peischer attempts among other things to minimize the importance of the Becker Oven.

Dr. Peischer of Essen, is in the employ of Heinrich Koppers, Essen, and has general charge of propaganda and publicity. A favorable consideration of the Becker oven from this source is hardly to be expected, since competitors of Heinrich Koppers are now building these ovens in Europe.

Dr. Peischer has never had an opportunity to observe the Becker Oven in operation. His discussion is not based on practical experience, but upon unsound theory. There seems to be no necessity for undertaking to enlighten Dr. Peischer and his associates in these matters and it is not my intention to open a long controversy on this subject, but your readers may be interested in the following brief observations:

1. The American Koppers Company has installed in America about as much Koppers oven capacity as

exists in Germany, and probably knows as much about the merits and defects of this oven as anyone in Germany. It has also built a great many Becker ovens and has decided to build Becker ovens exclusively, although it could go on building Koppers ovens if it so desired. It undoubtedly knows a great deal more about Becker ovens than anyone in Germany.

2. The American Koppers Company tried in a great many ways to overcome the defects in the old Koppers oven. At the suggestion of Heinrich Koppers, it tried to overcome these defects by the use of vertically tapered oven chambers. It has made a very careful study of the results as secured by the German tapered design, as compared with those obtained by the Becker oven without taper, and is satisfied that the Becker oven is vastly superior and requires no taper.

In the past three and one-half years, 1337 Becker ovens, with an annual carbonizing capacity of about 11,000,000 tons of coal have been contracted for in America. In the case of each contract, the superiority of the Becker oven to the Koppers oven has been conclusively demonstrated to the prospective purchasers by actual oven tests on their own coals.

It ought to be obvious that the American engineers, upon whom rests the responsibility of buying coke oven plants, are perfectly competent to judge between the outstanding differences in the performance of Koppers and Becker ovens.

3. So far as vertically tapered walls are concerned, the American Koppers Company has the full right to build the Becker oven or even the Koppers oven, with such walls if it so desires.

4. It is well recognized by coke oven designers that the necessities in regard to the size and location of the horizontal flue constitute a serious limitation in the design and operation of Koppers and similar ovens. Heinrich Koppers in his recent English Patent No. 204,345 filed September 25, 1923, and accepted May 22, 1924, states "the horizontal channels extending along the tops of the heating flues and connecting the same introduce a difficulty in regard to securing the proper distirbution of the gases, because for constructonal reasons the horizontal channels must be comparatively small, though they have to take the whole of the waste gas from the heating flues of half the oven. The quantity of wase gas is considerable, more particularly if poor gas is used for heating...". By "poor gas" he means producer gas or blast furnace gas. He then proceeds in this recent British Patent to disclose that he conveys gases from the horizontal flue of one or several heating walls across the top of the oven chambers into the horizontal flue or several of them, of other heating walls, and in such way makes it possible to reduce the cross section of the horizontal flue and eliminate those disadvantages that are stated in the hereinbefore quoted part of his specification, thus adopting the same priinciple that is employed in the Becker oven.

5. In comparing the flue designs of the Becker and Koppers ovens, Dr. Peischer freely admits the superiority of the Becker oven design in the following words: "It must at once be admitted that by this means the structurally troublesome horizontal flue can be reduced in size. This is certainly an advantage which, however, as will be pointed out later, involves certain disadvantages."

6. The first disadvantage which he claims is: "The heating flues are higher, and so the natural drop from below upwards in the flame temperature is further intensified." It is well recognized that one of the principal defects of the Koppers oven is that the vertical heating flues are considerably too short for the uniform application of heat to the coal mass. This is due to the large size of the horizontal flue, and the fact that its location cannot be changed without encountering other serious difficulties. The increased height of the vertical flues is one of the outstanding advantages of the Becker oven.

In the same paragraph, Dr. Peischer admits that the distribution of flame heat in vertical flues can be controlled by air port design, thus nullifying his own objection to the height of the flues. As a matter of fact, the heat distribution in Becker ovens is so well under control, that a number of batteries have oven chambers 13 to 13½ feet high, or two feet higher than the European maximum.

7. The second disadvantage claimed, is that the somewhat increased area of the Becker oven regenerator partition wall separating air and waste gases provides a greater opportunity for leakage. Actual tests have shown that the regenerator leakage is not more, but in fact less than in the Koppers oven. The reason for this is that the Becker oven regenerator partition walls are solid and continuous from end to end, whereas in the Koppers oven these walls are provided with expansion joints which never close up, and which provided relatively easy passage to air and waste gases in adjoining regentrator chambers.

8. Narrow coke ovens are not a modern innovation, as Dr. Peischer seems to think. Forty years ago* a battery of twenty-five 14½-inch Semet-Solvay ovens were put into operation at Havré Colliery. These ovens were 30 feet long and 5 ft. 8 in. high. A battery of thirty ovens having the same dimensions were put into operation at Northwich, Cheshire during the following year. Therefore, the mere reduction in width of ovens cannot be credited to Heinrich Koppers.

9. The American Koppers Company, and undoubtedly Mr. Becker, also, has long known that when oven width is reduced, there is a somewhat more than proportional reduction in the coking time. For example, Ramsburg and Sperr in a paper given in 1917 before the American Institute of Mechanical Engineers stated: "It becomes apparent at once, in a comparison between a 16-inch and a 20-inch oven, that the following is true....... With the same wall temperature, more coke can be made per day in the narrower oven than in the wide one."

10. However, the effect of oven width on the rate of coking is not nearly so great as Dr. Peischer claims. American coke oven operators will at once apprecate the absurdity of his attempt to compare a 24-hour coking time in 19.7-inch ovens with a 12-hour coking time in 13.7-inch ovens. In American practice, a coking time of 18 hours or less is obtained in the regular operation of 19.75-inch ovens.

* * * *

All of this simply means that Dr. Peischer has made statements which are not based on facts, at least s ofar as the American coking industry is concerned, and that his article is decidedly misleading.

---

*R. A. Mott. "By-Product Coke-Oven Practice—V", Fuel in Science and Practice, pp. 185-193, May 1925.

Current Literature on Ferrous Metallurgy

By E. H. McCLELLAND*

Analyzing blooming mill operation. W. H. Bailey. *Iron Trade*, v. 76, June 4, 1925, p. 1454-1455.

Annealing iron and steel in the electric furnace. Harold Fulwider. *Fuels and Furnaces*, v. 3, July 1925, p. 731-732.

Balance reactions in steel manufacture. A. McCance. *Iron and Coal Trades Rev.*, v. 110, June 19, 1925, p. 1002-1003.

Serial.

Centrifugal casting calculations. Robert F. Wood. *Metal Ind.*, v. 23, May 1925, p. 186-189.

Discussion of article in *Blast Furnace and Steel Plant*, July 1922.

Chemical reactions of the basic electric process. Frank T. Sisco. *Iron and Coal Trades Rev.*, v. 110, June 12, 1925, p. 953-956.

Composition and functions of slag. M. J. Bradley. *Fuels and Furnaces*, v. 3, July 1925, p. 721-724.

Cutting tomorrow's labor costs. H. A. Frommelt. *Iron Age*, v. 115, June 18, 1925, p. 1773-1774.

Apprentice training in foundry work, promoted by Milwaukee Metal Trades.

Electric pig iron manufacture in Sweden. J. A. Leffler. *Iron and Steel of Canada*, May 1925, p. 100-102.

Electro-metallurgy of iron and steel in Italy. F. Giolitti. *Iron and Steel of Canada*, May 1925, p. 103-106.

Paper before World Power Conference.

Etching cutlery; a detailed article on the methods and chemicals used in etching steel knives. Joseph Haas. *Metal Ind.*, v. 23, June 1925, p. 226-227.

Function of ferric oxide in acid and basic open-hearth slag. J. H. Whiteley. *Iron and Coal Trades Rev.*, v. 110 June 12, 1925, p. 952-953.

Furnace lining wears unevenly; temperature and shape of lining after fourteen months operation; suggested methods of control. S. P. Kinney. *Iron Age*, v. 115, June 4, 1925, p. 1639-1640.

Relates to 300-ton blast-furnace.

Gates and risers. F. C. Edwards. *Iron and Steel of Canada*, June 1925, p. 118-123.

Gerwinnung und verwendung von sauerstoffangereicherter luft im hüttenbetriebe. A. Brüninghaus. *Stahl u. Eisen*, v. 45, May 14, 1925, p. 737-748.

Handling steel chips; bin and portable air hoist save floor space in chip disposal. W. H. Wineman. *Iron Age*, v. 115, June 11, 1925, p. 1714.

Herstellung und anwendungsgebiete von nichtrostendem eisen. H. Esselbach. *Giesserei-Zeitung*, v. 22, June 1, 1925, p. 317-321.

Importance of venting, with special reference to defective castings. E. Longden. *Metal Ind.* (*London*), v. 26, May 15-29, 1925, p. 489-490, 511-514, 534-538, 540.

Large diameter centrifugal pipe; new British process for 36-in. castings; annealing found unnecessary; principles of the Hurst-Ball and other systems. J. E. Hurst. *Iron Age*, v. 115, June 11, 1925, p. 1704-1706.

Large uses of steel in small ways; radiator furniture. *Iron Trade*, v. 76, June 11, 1925, p. 1524.

Line annealing furnace bungs. Meredith F. King. *Foundry*, v. 53, July 1, 1925, p. 535, 540.

Looping blooming mill; unusual type, over 20 years old, designed for flexibility in operation. *Iron Age*, v. 115, June 11, 1925, p. 1707.

Making cast stainless steel. J. M. Quinn. *Foundry*, v. 53, July 1, 1925, p. 515-518, 525.

Making patterns a business asset. E. H. Trick. *Foundry*, v. 53, July 1, 1925, p. 509-511.

Marking patterns carefully keeps records straight. Walter C. Ewalt. *Foundry*, v. 53, June 15, 1925, p. 492, 501.

Mill scrap specifications submitted. *Iron Age*, v. 115, June 4, 1925, p. 1626-1630.

Report of convention of National Association of Purchasing Agents, at Milwaukee. Includes proposed classification of scrap specification for the rolling-mills.

Patterns gain strength when proper joints are used. Walter C. Ewalt. *Foundry*, v. 53, July 1, 1925, p. 536-540.

Physical chemistry in steel-making. R. A. Hadfield. *Iron and Coal Trades Rev.*, v. 110, June 12, 1925, p. 947.

Abstract of paper before Faraday Society, and Iron and Steel Institute.

Practical notes on refractory materials. Vincent C. Faulkner. *Fuels and Furnaces*, v. 3, June 1925, p. 579-581.

Abstract of paper before Institute of Metals.

Punchings require careful annealing; heat treatment affects efficiency of electric motors, generators and transformer cores in which they are used; one plant's methods. *Iron Age*, v. 115, June 18, 1925, p. 1775.

Rapid determination of molybdenum in steel. O. L. Maag and C. H. McCollam. *Industrial and Engineering Chem.*, v. 17, May 1925, p. 524.

Reactions of the basic open-hearth furnace. T. P. Colclough. *Iron and Coal Trades Rev.*, v. 110, June 12, 1925, p. 947.

Recommend microscope as control instrument. J. Fletcher Harper and H. J. Stein. *Foundry*, v. 53, June 15, 1925, p. 487-489, 502.

Secures uniformity in ladle iron. H. R. Simonds. *Foundry*, v. 53, June 15, 1925, p. 480-482.

Slag reactions. Peter M. Macnair. *Iron and Coal Trades Rev.*, v. 110, June 12, 1925, p. 951-952.

Abstract.

Surface cracks in rolling steel; nine varieties originating in ingots; causes of snakes and how to combat them; effect of quality of steel. Henry D. Hibbard. *Iron Age*, v. 115, June 25, 1925, p. 1837, 1879-1880.

Serial.

Tubing made from strip stock; how flat stock is rolled and sweated into double-wall tubing. Charles O. Herb. *Machinery*, v. 31, Apr. 1925, p. 602-605.

Ueber erfahrungen mit dem Schnürmann-ofen. Ludwig Franz. *Giesserei-Zeitung*, v. 22, May 15, 1925, p. 277-282.

Verbrennlichkeit und festigkeit von hüttenkoks in grösseren körnungen. F. Häusser. *Stahl u. Eisen*, v. 45, June 4, 1925, p. 878-885.

Vertical-horizontal blast-furnace chargers. C. E. Raeburn. *Iron and Coal Trades Rev.*, v. 110, June 5, 1925, p. 909-911.

Welded joints in cast-iron pipe. C. H. S. Tupholme. *Iron and Steel of Canada*, June 1925, p. 126-127.

---

*Technology Librarian, Carnegie Library of Pittsburgh.

Foreign Trade and International Stability

Resume of Speech Before the National Foreign Trade Convention, Seattle, Washington

By EDMUND A. WALSH*

WORLD trade, in common with most phases of modern life, has become vastly more complex than ever it was in the past. There were times in the history of international commerce when one power dominated the scene—the Phoenicians in their days, or the Genoese, or the Venetians, or the Hanseatic League, or Spain, or Portugal, or Holland. But the flags of every maritime nation dot the high seas today in keenest competition. A recent computation made in the Bureau of Foreign and Domestic Commerce at Washington shows that the foreign trade, i. e., exports and imports, of 46 nations last year reached the impressive total of approximately $49,000,000,000. Suppose we divide the world population of 1,700,000,000 into that figure. The resulting wealth-turnover of approximately $28 per capita will enable us to visualize how intimately and extensvely foreign trade affects the individual, whereas previously its effects were restricted both in area and volume to the major commercial nations.

This increased facility in transportation and communcations has resulted in bringing distant shores and peoples nearer together. The world has grown narrower. Concomitantly, the organization of world business, based on world-wide credit, becomes more and more sensitive as it develops, as happens in all forms of organic life. The more highly organized the structure, the more delicate the nervous system. This growing co-ordination of business enterprises creates a mutual dependency so that even a small break or interruption in transmission may vitally affect the whole circuit. What would happen to the British textile industry if its raw materials were shut off; or if its markets for manufactured products disappeared? And we dread to think what would take place in our rubber industry if the supply were discontinued from the Malay Peninsula and the Dutch East Indies. Whole industries depend on foreign trade; likewise the employment of millions of men.

And the same dependency is true of our jute supplies from British India, our sisal from Yucatan, our silk from China and Japan, and our camphor from Japan.

The price we pay for domestic grain is frequently determined, not by local supply, but by world demand. And the geologists are warning us that the world supply of basic minerals is being so rapidly consumed that grave political consequences are not improbable. Geology and geography may soon be the ultimate determinants of peace and war. Professor Leith of the University of Wisconsin, tells us in a recent illuminating study of the problems involved in "The Control of Mineral Resources" that one begins to hear the phrase "internationalization" of mineral resources. It comes up in connection with the League of Nations, with the peace settlement and with various projects for world peace. (Cf. "Foreign Affairs," July, 1925.

The location of mineral deposits, their exploitation, development and subsequent distribution through trade channels are no longer questions concerning merely the nation within whose boundaries the deposits are found. Metals and oil are looming larger and larger on the international horizon, as statesmen realize the following facts, established by the geologists:

1—The world has consumed more of its mineral resources during the last 20 years than in all preceding time.

2—There are comparatively few deposits capable of meeting these requirements with the result that there now stand out a few dominating centers

Iron ores, though widely scattered, are principally found in a few definite regions; three-fourths of the world supply is mined in five localities, viz:

a. Lake Superior region of the U. S. A.
b. Northeastern France
c. Cleveland, Lincolnshire, Northamptonshire and Cumberland districts of England.
d. The Kiruna district of Sweden.
e. Northern Spain.

The remaining **one-fourth** of the world supply is scattered.

The steel industries using these ores are naturally concentrated near the reserves and near supplies of coking coal. Hence, over 90 per cent of the world's steel capacity is confined to **three regions,** viz:

a. In the United States, centering about the lower Great Lakes.
b. In Northern England.
c. In the Ruhr, and adjacent portions of Northeastern France.

The ferro-alloys, necessary in the making of iron and steel art still more limited.

Manganese—Mainly from India, South Russia and Brazil.

Chromite—From Rhodesia, India and New Caledonia. China has some deposits. The United States has probably something like 18,000 tons, which would be exhausted in four or five years.

Nickel—Mainly from a single district in Canada. (Property owned and operated by Americans.)

Tungsten—Sixty per cent from China.

Vanadium—Fifty per cent from Peru. (Owned and operated by an American company). Slightly found in Colorado and Utah.

Tin—Three-fourths of world's tin comes from the Malay Straits, Bolivia and Dutch East Indies. Practically no production in the U. S. A.

Platinum—Russia. (United States one of largest users in the world—has no production.)

Gold—Over 50 per cent from Union of South Africa. South Africa has practical monopoly of diamond production.

Potash—Germany has a natural monopoly in the Strassfurt district; and in Alsace.

Nitrates—(For fertilizers) exclusively from Chile.

In lead, zinc, silver, copper, sulphur, etc., the U. S. A. is one of the leading producers.

---

*Regent, Georgetown University, Washington, D. C.

Turning to coal and oil, the record is more assuring for the United States.

Bituminous coal, for coking and efficient power uses, is chiefly found in **three places** in the world:

a. Eastern United States, which has 50 per cent of the world supply.

The northern hemisphere seems to have been designed by nature as the main coal producing area, as the southern hemisphere has less than **one-tenth** of the estimated world reserve.

China has certain substantial, but undeveloped, reserves. The Donetz coal basin in Russia may be mentioned, but its productivity followed the descending curve of all Russian industry.

Anthracite production is more limited still, being confined practically to Eastern Pennsylvania, which accounts for 95 per cent of the world supply.

The remainder comes mainly from Wales.

In oil, the position of the United States is priviledged.

We have produced more than 65 per cent more than all other lands combined.

Russia, Mexico, Dutch East Indies, Roumania, Galicia account for about 30 per cent.

The remaining 5 per cent is scattered—Persia, Mesopotamia, etc.

(Figures and statistics from Prof. Leith of the University of Wisconsin, in "Foreign Affairs," July, 1925.)

The world struggle for petroleum needs no recounting to this audience. Let me only remind you that our share of the total estimated world supply of 70,000,000,000 barrels is approximately 10,000,000,000 barrels. This represents about 14 per cent of the world supply. But unlike the rest of the world, which is consuming its reserve at the rate of about **six-tenths of one per cent per annum,** we are using our supply at the rate of nearly six per cent per annum. This means that, if the rate of usage is not checked, or if new deposits are not discovered, we shall have exhausted our reserve in less than 20 years. As it is, we consume far more each year than we allocate for domestic use, being obliged to import something like 130,000,000 barrels per annum.

No student of international relations will require proof of the proposition that in the proper conduct of world business, based on sound commercial policy, lies the key to universal peace and international stability.

The making of such sound, commercial policy is as important as the making and maintaining of sound, political policy in international relations. In modern times it is a truism to remind ourselves that politics and economics are now but two sides of the same coin. We have evolved a definite, rational, political creed in these United States, a political philosophy proved and confirmed by one hundred and fifty years of experience, a body of political principles embodied for all to read in the Declaration of Independence, in the Constitution of the United States, and such periodic utterances as the Monroe Doctrine. It has kept us a free and independent nation during political and dynastic changes that have transformed the map of Europe during that time. It is well within the scope of these national foreign trade conventions to disseminate such sound commercial beliefs as will maintain both our economic independence and our good relations with the rest of mankind.

It is no longer true in international relations that everybody's business is nobody's business. On the contrary, American business interests, as a whole, involve joint responsibility with the business men of the entire world. Do you require proof of this? You have it in abundance in the numerous international conferences so frequent during the last ten years—postal conventions, trademark conventions, patent conventions, copyright conventions, labor conventions, health conventions and the like.

Let us now be practicable. The formulation of a national commercial policy is not a mysterious process, produced by hidden, unknown forces, as the prestidigitator produces the rabbit from your tall stiff hat, nor is it to be left as an occasional exercise of legislative power by the temporarily elected representatives of the people. Political power under our system of government is delegated power, and the rulers of the nation are but the agents of the people and the responsible executors of the national will. Hence, in determining the conditions under which international commerce is to be conducted, an enlightened public opinion ad an informed public conscience must proceed, not follow, legislative enactments. This means the education of our people to an understanding of the nature of modern commercial relations—the cultivation, in a word, of the **international mind.**

Such a mind understands that the same elements will preserve or disturb stability in the great family of nations that preserve or disturb stability in the individual families which go to make up nations. Now what are the elements that preserve the peace, and insure happiness, and promote the welfare of individual families? They seem to me to be:

1—Mutual understanding and a brotherly respect for each member's rights and interests. Domestic peace was never preserved in a family run on the policy "Everyone for himself and the devil take the hindmost."

2—A willingness on the part of the individual members to subordinate their own personal interests to the common good of the entire group.

3—Co operation in the daily process of life in fact, as well as in theory.

Similarly, international stability, which results from the friendly, harmonious and balanced intercourse between nations, will be safeguarded by:

1—Mutual understanding and respect manifested towards foreign nations and their nationals.

2—You will remember that I put down as the second element in maintaining private domestic tranquility, a willingness on the part of the individual members to subordinate their personal interests to the common good of the entire group. Although in international relations there is not the same positive obligation for one nation to submerge its own interests in favor of another nation, there does exist, however, a negative precept founded on commutative justice, prohibiting any nation from arbitrarily advancing its commercial interests at the expense and cost of another.

3—I name as the third element making for harmony in domestic relations, an honest co-operation in deed as well as in theory. So, too, in international commerce, necessity, if not virtue, is gently bringing the commercial powers to recognize the advisability of voluntary international co-operation. Economic imperialism is a breeder of suspicion and hatred; and racial hatred is a preamble to war.

Abstracts of Papers

Division of Industrial and Engineering Chemistry, Los Angeles Meeting in August

Motor Benzol, by E. L. Hall.

The removal of sulphur compounds and naphthalene from gas used for domestic purposes is essential. The increasing sulphur content of the crude petroleum used in the manufacture of oil gas by the Portland Gas & Coke Company made imperative the installation of additional purification equipment. The use of wash oil, which would remove the objectionable sulphur and naphthalene compounds and at the same time the benzol compounds, was adopted. The process used to treat a maximum of 900,000 cu. ft. per hour of crude oil gas is described and illustrated with diagrams and photographs. The crude benzol is purified by distillation and chemical treatment; chemically pure benzol and all the commercial grades being produced, chief of which is the motor benzol.

The Decomposition of Liquid Hydrocyanic Acid, by Mark Walker and D. N. Eldred.

The storage of liquid hydrocyanic acid containing 96 to 98 per cent hydrocyanic acid precents a unique problem alike to manufacturer, transportation carrier and consumer. Numerous explosions have occurred in attempting to store the liquid confined in closed containers. During the past few years large quantities of this commodity have been manufactured, transported over the public highways and stored in warehouses, or specially constructed sheds, for indefinite periods of time. Because of the high toxicity of the materials to nearly all forms of life, and the violence of the explosions, it became increasingly important to determine the nature of the causes that led to these explosions.

A study of the behavior of liquid hydrocyanic acid, confined in steel bombs under controlled temperatures and pressures, alone and in the presence of "catalysts" and "stabilizers," has been made. In this study, time-temperature, time-pressure curves and the character and composition of the products of the reaction have been determined.

As a result of this investigation the explosions above referred to were found to result from the rupturing of closed containers due to the formation of gases caused by the exothermic polymerization and decomposition of the liquid. Pressures of over 1,000 lbs. per square inch were frequently experienced in this work. At atmospheric temperature, polymerization without a sudden rise of pressure may result due to the balance established between the heat of reaction due to decomposition and the loss of heat by radiation.

The products of the reaction were found to be (1) a solid black mass resembling willow charcoal or powdered carbon which upon analysis proved to be a polymer of hydrocyanic acid slightly deficient in hydrogen and nitrogen and (2) various gases, among which ammonia and carbon monoxide predominate.

Gaseous mixtures of hydrocyanic acid and air varying from 11 per cent to 60 per cent of hydrocyanic acid by weight, will explode when ignited. It is believed, however, that the explosions referred to in this work do not belong to this class.

Manufacture of Hydrochloric Acid from Chlorine, by Wilhelm Hirschkind.

The reaction between chlorine steam and coke is utilized. The temperature must be high enough to form water gas which reacts with the chlorine. Provided chlorine and steam are in theoretical proportions the reaction products are only hydrochloric acid and carbon dioxide and the reaction is independent of the state of the water gas equilibrium. The reaction is strongly exothermal with a 90 per cent chlorine gas and an equivalent amount of steam. A reaction temperature of 900 deg. C. is maintained while a 75 per cent hydrochloric acid gas is produced.

Motor Alcohol, by J. P. Foster.

The use of molasses and nipa palm sap in the production of motor alcohol is strictly an economic question. Technical issues involved in manufacture as well as in the use by standard automobile engines have been satisfactorily solved. A denaturant such as ammonia, pyridin, or analine is used which will also serve to neutralize acidity in the fuel and the products of combustion. Easy starting, elimination of knocking, and freedom from carbon troubles are characteristics of alcohol motor fuel. The industry is firmly established in the Philippines and South Africa.

Nitrogen Fixation in the State of Washington, by H. K. Benson and W. L. Beuschlein.

In the state of Washington, 94 per cent of the electric power is produced by water power as contrasted with 34 per cent in the United States as a whole. The municipally owned plants of Tacoma and Seattle, together with highly developed privately owned systems are all interconnected, thus providing a ready means for the disposal of surplus and seasonal current.

This class of current is sold for as low as $10 per kw. year. In general, the city ordinances permit the sale of continuous current to the chemical industries for $30 per kw. year with monthly discounts in favor of the buyer. By a combination of these two kinds of current it is evident that certain electro-chemical processes can be operated under favorable conditions. The arc process of nitrogen fixation is one of these. Each furnace has a consumption of 600-1000 kw. and in a factory of 12 or 15 furnaces the operator can throw in or cut out at will in accordance with the amount of current furnished, each furnace reaching maximum efficiency with a few seconds of operation.

The only arc plant in America has been in operation at LaGrande, Wash., since 1916 and has recently enlarged its capacity to supply the American demand for sodium nitrite. The plant is operated by the American Nitrogen Products Company of Seattle, Wash. The Wielgolaski furnace was developed from the original patent drawings and now gives a very satisfactory yield of about 60 grams nitric acid per kwh. After partically cooling the gas, it enters absorption towers and reacts with alkali to form nearly pure sodium nitrite in accordance with the reaction: $N_2O_3 + 2NaOH—2NaNO_2 + H_2O$. This solution is evaporated, crystallized, dried and reaches the market in paper lined barrels.

A second process in the nitrogen fixation group of industries is that of synthetic ammonia operated by the Pacific Nitrogen Corporation on the shores of Lake Union, Seattle. Electrical energy is used to decompose water for the production of hydrogen. This is mixed with the requisite amount of air, the mixture is deoxygenated, purified at low pressure and finally ammonia is synthesized in the presence of a catalyst at a pressure of 300 atmospheres.

Digitized by Google Original from UNIVERSITY OF MICHIGAN

THE SAFETY CRUSADE

Ore and Coal Bridges Made Safe

Wellman-Seaver-Morgan Perfect Safety Stop Equipment Which Withstands Severest Tests

By W. G. HILDEBRAN*

OWNERS and operators of large traveling structures such as ore and coal-handling bridges, large gantry cranes, etc., have long realized the necessity of reliable means for holding such structures during high winds.

Appreciating the need for such protection and its wide field of application, the Wellman-Seaver-Morgan Company has developed an arrangement of bridge safety stops designed to meet the severe conditions under which they must be effective.

An installation of the W-S-M safety stops has been in service for a continued period on a large coal storage bridge at Buffalo, N. Y. This bridge, shown above, is in a very unfavorable location on the open lake front, being exposed to violent winds from all directions. On completion the equipment was subjected to a series of very severe tests, and has since safely held the bridge in all kinds of storm and weather conditions.

Another installation is now being built for application to a 10-ton ore-handling bridge operated by the U. S. Steel Corporation.

The W-S-M safety stop equipment consists of a system of multiple wedges, or stops, automatically placed on the runway rails adjacent to the outermost wheels under each bridge sill.

While the bridge is stationary each wedge is securely held on its rail by means of a clamping mechanism which is integral with the wedge. Each stop is operated by its own independent counterweight.

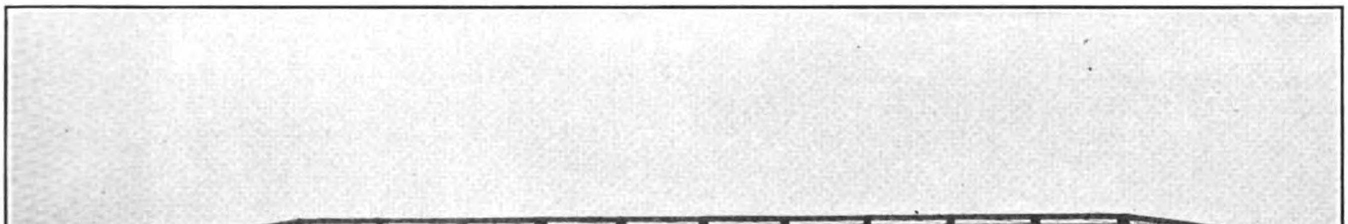


FIG. 1.—*A safety equipped coal storage bridge at Buffalo, N. Y.*

---

*Cleveland, Ohio.

While the bridge is traveling, the safety stops are withdrawn from the wheels and rails by electrically operated lifting devices placed on the bridge sills.

Wedge Principle Utilized.

It will be observed that the principle of the wedge placed between a wheel and rail is used in the W-S-M safety stop arrangement. It is an accepted mechanical fact that the wedge is the most efficient means of stopping forward motion of a wheel on its rail and that very little holding effort is necessary to prevent the movement of such a wedge along the rail.

With the W-S-M safety wedges locked to the rails, excessive wind pressure on the bridge tends to roll the wheels up the incline of the wedge. In this position the wheels naturally tend to return down this incline, presenting a great resistance to the force of the wind. In addition to the above factor, great resistance against movement of the bridgt is caused by the friction of the bridge on the top of the rails when the wheels have rolled upon the wedges.

As the stops (wedges) are placed under the outside wheels, at the extreme end of the sills, the pressure on the wedges increases proportionately with the wind velocity, thus automatically increasing the friction on top of the rail and the resisting power of the stops.

Control Arrangement.

The releasing and setting of the safety stops is controlled by the operator stepping on or off a platform in front of the bridge controller wherever it may be located. In this way the operator quickly releases the stops when he wishes to move the bridge and they are automatically applied when through traveling, by his leaving the controller platform. The wedges, however, are not suddenly clamped to the rails, as will be explained later.

Each stop consists of a cast steel frame, to whch the wedge portion is bolted. The lower portion of the main casting also forms a support for clamp levers arranged to grip the sides of the rail head with only a moderate pressure to prevent horizontal movement of the wedge along the rail. The upper ends of the clamp levers are connected by means of adjustable toggle thrust members to a counterweight lever which is also supported in the upper part of the main stop casting.

Releasing.

When in its engaged position the stop rests entirely on the runway rail to which it is clamped by the action of its counterweight, at which time the stop has no rigid connection to the bridge. Three slotted links connect each stop to the bridge sill for the purpose of suspending the stop when out of operation while the bridge is traveling. Two links attached to the stop counterweight are connected to a lever on the sill, so arranged that the jaws are released during the initial part of the lever travel and the stop moved upward and backward during the final travel.

The third link s connected between the forward end of the counterweight arm and the sill, and supports the forward end of the stop in its released position.

All the safety stops under each bridge sill are connected by rigid operating connections to the common lifting device supported on that sill.

The lifting devices are very substantial mechanisms mounted on rigid bed plates and well covered. Each consists of an electric motor connected by means of a flexible coupling to the worm gear reduction unit which drives a spur pinion through a magnetic clutch. The spur gear meshing with this pinion revolves the shaft carrying the levers which operate the previously mentioned connections leading to the stops. A dash pot lever and electric limit switch are also operated by this shaft.

The coil portion of the magnetic clutch has ratchet teeth which engage a pawl to prevent reverse rotation, and accidental application of the stops.

Operation.

A single master starting switch for all the lifting mechanisms is operated by a platform upon which the operator stands while moving the bridge. This switch is electrically connected to the single magnetic control switch pannel containing contactors for starting and accelerating the motors and energizing the magnetic clutches of the lifting machanisms.

When the master starting switch is closed by the operator stepping on the platform, the clutches are energized and the motors started. As soon as the lever shafts have rotated enough to release and lift the stops, limit switches cut out the motors but do not cut out the clutches. The pawls prevent reverse rotation of the shafts so that the stops will remain disengaged and free from the rails and wheels as long as the operator stands on the platform while the bridge is traveling. When the operator leaves the platform after traveling, the master starting switch is opened. The clutches are thus released and the stops automatically lower into the holding position and are clamped to the rails by the counterweights. The liquid-red dash pots prevent too rapid fall of the stops and their counterweights. The motor limit switches are automatically reset as the stops are lowered.

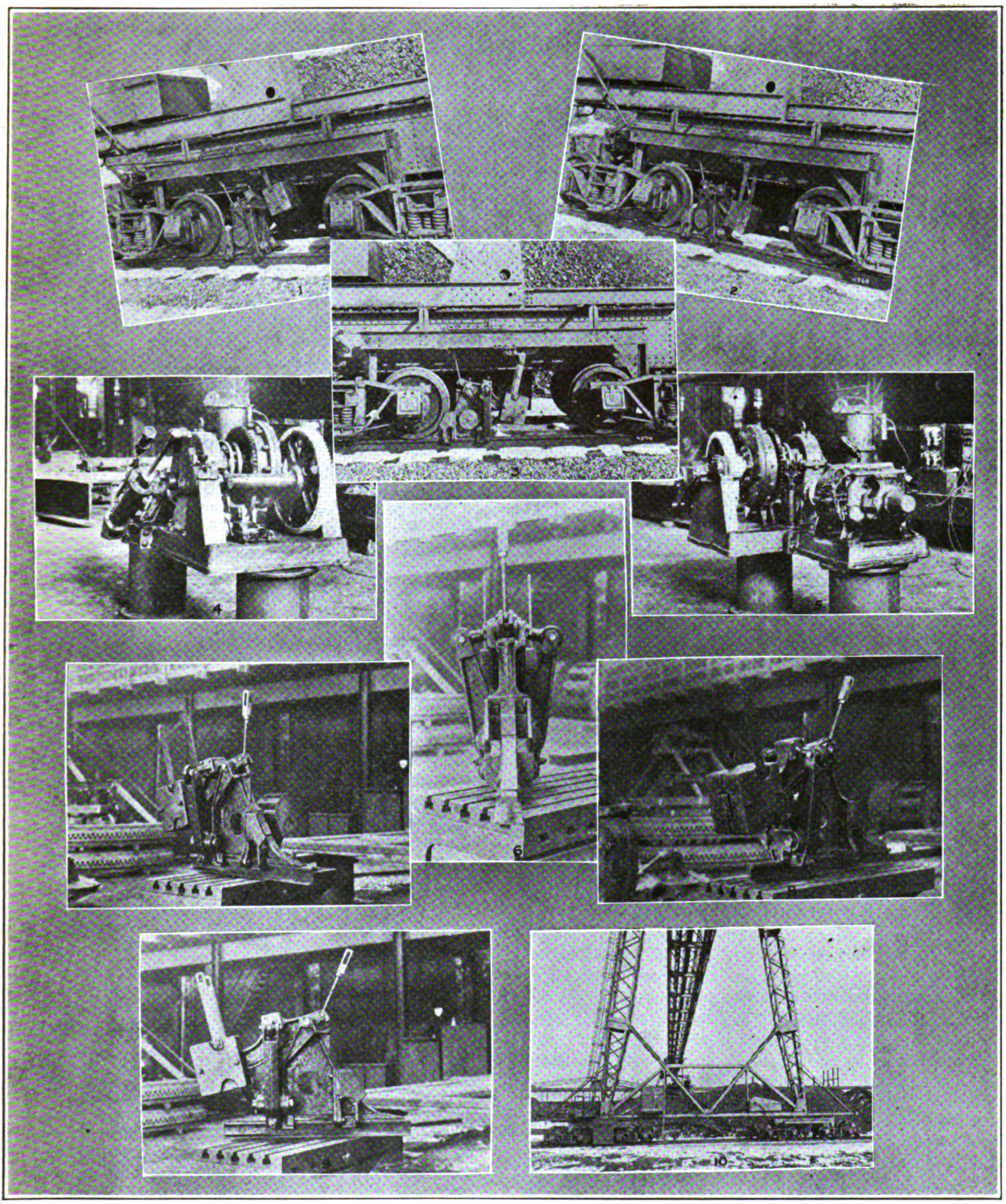
Automatic Clamping.

The wedge with its clamping mechanism is a self-contained unit which automatically clamps itself to the rail head wherever it may be placed. In fact, when the bridge is at rest the three suspenson links are absolutely loose and the stop is securely clamped to the rail independent of the bridge. The bridge is simply a carrier which moves the stops from place to place when they have been released from the rails and properly places the stops under the wheels as the bridge comes to rest.

The wedges are placed on the rails and clamped by gravity, entirely independent of any other power, and the clamping pressure on the rail heads is enough to positively prevent the wheels pushing th ewedges away before rolling upon them.

Application of the wedges is accomplished by the operator stepping off the platform so that they are applied at all times except when the operator stands on the platform while moving the bridge. A self-centering device for the master controller is necessary with this equipment.

Should the current fail while the bridge is traveling, the stops automatically lower into position but are not immediately clamped to the rails due to the retardation of the liquid-filled dash pot of the lifting mechanism. This produces a very effective braking action on the bridge as the wedges upon which the



DETAILED ASSEMBLY—FIG. 1.—*Three-quarter rear view W-S-M safety stop wedge unit. Showing wedge units suspended on their links in released position clear of rail with counterweight up to allow bridge to travel.* FIG. 2.—*Three-quarter rear view W-S-M safety stop wedge unit showing normal set position of wedges while bridge is at rest. Counterweight down.* FIG. 3.—*Side view W-S-M safety stop wedge unit showing wedge unit in normal set position with counterweight down. Truck wheel rolling onto wedge.* FIG. 4.—*Three-quarter front view W-S-M safety stop lifting device showing motor limit switch, ratchet pawl and long stroke dash pot with time interval control valve.* FIG. 5.—*Three-quarters rear view W-S-M safety stop lifting device, showing motor, magnetic clutch and worm gear case.* FIG. 6.—*Front view W-S-M safety stop wedge unit clamped to rail, counterweight down. Showing wedge and small overall width.* FIG. 7.—*Three-quarter front view W-S-M safety stop wedge unit clamped to rail, counterweight down.* FIG. 8.—*Three-quarter rear view W-S-M safety stop wedge unit clamped to rail. Counterweight down.* FIG. 9.—*Side view W-S-M safety stop wedge unit clamped to rail. Counterweight down.* FIG. 10.—*End view 5½-ton coal storage bridge showing sill construction and application of W-S-M safety stops and pipe operating connections. Small housing on sill near right hand shear leg contains safety stop lifting mechanism. House, near left shear leg contains one bridge travel magnetic control unit. Stops in normal set position clamped to rails with counterweights down.*

Digitized by Google Original from UNIVERSITY OF MICHIGAN

wheels have rolled tend to slide on the rails until the dash pots allow the clamps to exert sufficient grip to lock the wedges to the rails.

The stops are very certain in their action and the operation requires no attention on the part of the operator.

As the stops when released are very flexibly suspended from the bridge sills, and are guided by the flanges which straddle the wheel faces and the rails, the stops are fully effective on rails which are crooked, bent or out of gauge. Worn rails do not hinder effective locating and holding of the stops as the clamping device is arranged to accommodate a considerable variation in the width of the rail head and also equalize the nominal gripping effort necessary to hold the wedge in position. No parts extend under the rail head nor is there any interference with rail splices or bolts. It is not necessary to grind or finish the rails for the W-S-M safety stops nor is it necessary to provide special rail splices.

Important Features.

With ordinary types of automatc rail clamps, the operators are inclined to render them inoperative on account of the slow release, and this "killing" of the clamps is very serious as it leaves the structure entirely unprotected.

One of the very important features of the W-S-M safety stops is the short time necessary to release the stops when it is desired to move the bridge. This interval is so short that the operator does not hesitate to start bridging after he has stepped on the platform.

The setting of the W-S-M stops on the other hand, involves quite a time interval so that the bridge is not stopped too suddenly. This period of time is adjustable and is fixed when once adjusted. It is uniform in all weather conditions due to the special liquid used in the long stroke dash pot on each lifting mechanism. The W-S-M stops and lifting mechanisms are fully operative in extreme winter conditions.

The braking load applied t othe bridge by the stops is taken into the bridge through the truck connection which is fully capable of taking these loads. No heavy separate structure is required.

In the W-S-M safety stops the friction on the rails is developed by the pressure of the direct wheel loads on the wedges. As a result of this the friction increases as the wind pressure increases.

It is evident that the stopping effort developed by the direct wheel loads on the wedges introduces compressive stresses only in these parts. In ordinary types of automatic rail clamps the stopping effect is produced by grips, or clamps, acting on the sides of the rail head. To develop any holding power the grips or clamps are forced against the rails by levers actuated by powerful toggle mechanisms. Severe bending stresses are unavoidable in these slamping levers introducing a possibility of failure when most needed.

As previously mentioned, there are compressive stresses only in the W-S-M wedges, eliminating a serious weakness in design which is common to other types.

No severe stress or destructive effort is produced on the rails by the W-S-M safety stop.

With the W-S-M safety stop, friction loads are applied to the rails in close proximity to the wheel and these loads being vertical are transmitted directly into the rails creating a downward pressure which tends to hold the rails in their proper position in close contact with the runway foundation.

No part of the runway rails is as securely held on the runway as the portion directly under the trucks and for this reason this is the most suitable point of application of a holding device to resist movement with the wind.

Rail gripping devices are remotely located from the wheels and the holding loads must be transmitted by the rails acting as columns between the grips and the points under the wheels where the loads are taken into the runway foundations.

There is no danger of derailing a wheel on the wedges of the W-S-M stop, as the wheel is guided in alignment with the rail. Should a wheel or axle break, little damage can occur to the stops.

The safety stops are very substantially built, require no heavy structural parts to support them and take up but little space. Consequently, the W-S-M stops cause practically no reduction in storage capacity at the ends of stock piles.

The use of W-S-M safety stops does not interfere with the easy removal of bridge trucks as the removai of three pins at each stop completely disconnects it to allow access to the trucks.

The provision of multiple stops, i. e., a safety stop on each rail for each direction of travel, is an added safety feature. All tendency for the trucks to twist is thus eliminated.

Should a wheel have rolled onto a wedge and remain there, it will not prevent lifting of all the remaining stops. This is accomplished by an auxiliary release spring in each of the connections leading to the stops. The spring in this device is proportioned to automatically release and raise a stop as soon as the wheel has rolled off the wedge. These spring devices also prevent the breaking of any of the operating connections should a wedge remain under a wheel. They also permit the setting of the stops at the ends of the runways by engaging chocks on the rail.

There are light parts in the entire arrangement. Connections between the lifting mechanism and the safety stops are all substantial pipe members. There are no ropes used in any part of the device, nor are any brakes or solenoids used.

Summary of Advantages.

In conclusion, the following advantages and features of the W-S-M safety stop equipment may be noted:

Stops are automatically applied so that they are always set except when the operator is actually on the clamp operating platform.

Stops are automatically set in case of current failure.

Stops are positively in operation and control is extremely simple, requiring no attention on the part of the operator.

Uniform effectiveness of stops under all weather conditions.

Increasing effectiveness of stops as wind pressure increases.

Speedy release of stops.

Timed application or setting of the stops.

No harmful shocks in stopping the bridge.

Stops are applicable to runways and rails in poor condition.

(Continued on page 335)

Digitized by Google Original from UNIVERSITY OF MICHIGAN

The Development of the Recuperator

Desire to Protect Our Natural Resources and the Importance of Greater Fuel Economy Has Served to Stimulate Interest in Heat Recovery Through Recuperation

By **E. R. POSNACK***

TUT-ANKH-AMEN, the famous Egyptian king, lived in a remarkable age. The recently unearthed relics prove this and serve as striking evidence of the advanced state of civilization of a people living 3,000 years ago,—many centuries before the Dark Ages. Their pottery, vases and innumerable gold-embedded objects, their works of art and their utilitarian articles, demonstrate conclusively that the Egyptians were highly skilled in the arts and sciences,—that they were not ignorant of ceramics and metallurgy, and apparently possessed a working knowledge of practical methods for the application of heat.

Prehistoric Metallurgy.

Egyptologists, archaeologists, paleontologists and other antiquitarians have taught us through their discoveries that ages before the time of King "Tut" there existed peoples with varying degrees of civilization. As far back as 4,000 years before the era of that powerful Pharaoh, human beings knew enough about metallurgical processes to enable them to successfully smelt copper and tin ores, and to fabricate metallic implements. For even in the Bronze Age did they know the value of fire, and how to harness its energy for their own use. The practical application of heat constitutes one of the oldest industries known to mankind.

Early Furnace Development.

The methods employed for utilizing the heat of the flame were always very simple and crude—in fact it was only during comparatively recent times that they have taken the form of what might be called furnaces. The aim of those who built furnaces was solely to produce sufficient heat to melt their metals or to enable them to be worked into various forms for manufacturing purposes. Only several decades ago the success of an installation was measured entirely by its ability to obtain the required temperatures. The matter of fuel economy was relatively unimportant then, as the state of our natural resources and the extent of industrial competition did not warrant efforts in that direction. The science of metallurgy was not sufficiently advanced to require of a furnace close temperature regulation.

Recent Developments.

It is merely a matter of recent years that it has become necessary to direct any attention towards the conservation of fuel and the production of certain caloric effects demanded by our constantly increasing knowledge of metallurgy, such as high flame temperatures, elimination of oxidation, uniform furnace temperature, etc. To accomplish these objects, engineering research and inventive skill have devised innumerable ingenious methods, such as oil burners and atomizers, pulverized fuel systems, means for producing radiant heat, electric heating units, gas producers, stokers, insulating materials, refractories, improvements in general furnace design, and systems for the preheating of the combustion air, among many others.

Each of these has its particular field of usefulness, and has contributed its share towards the economical and diversified utilization of fuels for industrial heating purposes. However, there is unquestionably no one method that affords as many simultaneous advantages, as to the requirements of both economy and metallurgy, as the efficient preheating of air by the utilization of the waste heat in the stack gases.

Heat Recovery.

A brief word of explanation about air preheating and waste-heat salvage will be rather appropriate here. To burn any kind of fuel, large quantities of air are required. It has been generally recognized that if this air could be raised to a high temperature and injected into the furnace in this preheated state, instead of cold, higher furnace temperatures would be attained, thus widening and improving the field of metallurgical operations. It is also a well-known fact that of all the fuel used in a furnace, only a very small fraction performs useful work, the remainder being lost in various ways. By far the greatest part of this loss is effected in the stack. In other words, the smoke, or burnt gases, carry out and waste a tremendous amount of fuel energy — considerably more than is required to melt or heat the product. The joint and practical application of these two established facts—the establishment of a method of diverting this potentially useful heat from a waste channel to a production source— is the essence of the term, "utilization of the waste heat in the stack gases to preheat the air required for combustion".

The Regenerator.

About 70 years ago an engineer by the name of William Siemens, realizing that the future industrial world was to be built on a foundation of iron and steel, bethought himself of the commercial possibilities of an improved furnace system that would facilitate the economical attainment of the comparatively high temperatures required for the melting of iron. His alluring dreams materialized into an ingenious invention, the Regenerator, embodying a method of reclaiming the waste heat in the stack to preheat the combustion air. Today the name Siemens is synonomous with iron, and inseparably connected with steel. The development of the Siemens Regenerator is considered one of the most notable events in the history of industrial furnaces.

The regenerator now serves countless furnace installations — not only the large open-hearth and the gigantic reheating furnaces, but it is also an integral part of innumerable glass melting installations. It has progressed from the steel melting to the steel working industry, and expanded into the glass melting field.

---

*Mechanical Engineer, New York, N. Y.

In our age of industrial development and engineering research, 70 years is a rather long period of time. Great scientific revolutions and discoveries have taken place in briefer intervals. And it was 70 years ago that Siemens conceived the idea of his regenerator. One could justly ask, "Hasn't the regenerator, since its inception, undergone any radical change or improvement?" The answer would be that the regenerator of today is essentially and fundamentally the same as it was at its introduction into industry, although there have been changes in the details of its design, and additions and refinements in the form of improved supplementary apparatus. One might then be prompted to inquire, "Is the regenerator the only device of its kind in the industrial field? Have there been no further developments in the utilization of waste-heat and in methods of preheating air for industrial furnace operation?" The answer to this would be that their have been numerous ideas and inventions along these lines, notably in the salvaging of waste heat for power purposes, as in waste-heat boilers and blast furnaces; for the preparatory heating of stock in preheating chambers; and especially for the preheating of the combustion air.

Simplified Regeneration.

Developments in this last-mentioned category are of infinitely greater significance than the progress made in any of the other groups, for the reason that the method of air preheating lends itself to a more diversified and wider field than the others. In this class, of which the Siemens regenerator is the original member, there are two general methods employed for raising the temperature of the air—by the passage of the inlet air along the walls of the furnace, and by the system of recuperation or simplified regeneration —one of the most outstanding developments of industrial furnace research engineering.

The Recuperator In Europe.

It was about 20 years ago that the recuperator was first introduced into Europe. To say that it found a ready market there would be putting it very mildly indeed. One company alone has erected over 10,000 recuperative installations — not merely recuperative units, but complete furnaces embodying the recuperative principle. And this company is not alone in the field as there are many large competitive organizations doing an extensive business. The recuperative furnace is now the rule there and not the exception. The contagious adoption of this new method of heat conservation by manufacturers in every European country has been due mainly to the shortage of fuel, rendering the use of efficient combustion methods imperative to their industrial existence.

The situation in America was different. Endowed with great natural fuel resources, this country was under no such restraint as to fuel consumption as was imposed upon Europe. Hence to many manufacturers the matter of fuel economy was relatively unimportant, so that progress in this direction was rather slow. Production, not economy, was the keyword.

Introducing Recuperation In America.

That this condition could not last forever was quite evident. Post-war conditions, keen manufacturing competition, and the general awakening to the realization that our fuel supply was not limitless—these combined to set our industrial leaders thinking. Thus science, in its mission of cultivating the fields of industry with the seeds of production and the fertilizing agents of efficiency, was summoned to spread its stimulating and beneficial influence over the neglected soil in our territories of combustion and industrial furnaces. Its task, however, was a difficult one, for it encountered large tracts of barren lands of ignorance, covered with the weeds of industrial inertia — that stubborn resistance to change from the proved to the improved.

Proving the Improved.

The quality of inertia, although apparently not very conducive to industrial progress, is — paradoxically enough — not entirely a negative influence. When the improved becomes the proved, when the inertia-afflicted individual can be convinced that the new is better than the old, then all the energy spent in accomplishing this result is well worth the effort, for he will then follow the new path as persistently as he clung to the old one.

It soon began to dawn upon the American manufacturer that the recuperator was fundamentally simple in design, self-evident in principle, and positive in its operation. He could not deny that a blueprint showing the detail of a plain, cast-iron open-ended pipe required no further substantiation to prove that water could be made to flow through it than the drawing itself. He now began to realize that the recuperator was equally obvious in its workability.

As difficult a task as the introduction of the recuperator actually proved to be, it finally hit its stride in this country. In the short period of a little over a year, when it first wedged its way into American industry, it has grown with amazing rapidity. When the improved became the proved, when Missourians were shown and the skeptical convinced, when results of actual installations became available, then the characteristic American enthusiasm expressed itself in no uncertain terms. If the development of the recuperator in Europe may be descriptively compared with Contagion, then its spread throughout this country promises to become analogous to a conflagration.

The Recuperator In America.

An excellent proof of the sudden popularity of the recuperator in the United States is the appearance within the last year or so, of numerous large and extensive advertisements offering this form of equipment. Whatever industrial furnace advertising had been done previously made no mention at all of recuperation or related apparatus. Now we find that many nationally-known technical periodicals and trade journals carry advertising matter that constitute conclusive evidence of the growing popularity of this new method of heat conservation. These "ads" are all of the display type, occupying frontcover and mid-section positions, being full and double-page in size, and prominently displayed in colors. They are the most conspicuous and largest of all industrial furnace advertisements, for they offer a product of great interest and inestimable value to every user of heat for industrial purposes — a product whose many sales features render it peculiarly adaptable to advertising — and selling.

From a perusal of these advertisements it will be noticed that there are, at the present time, but four companies offering recuperative equipment. It will also be observed that these four concerns are rather prominent industrially and financially, and of the type that would not venture into "fly-by-night" propositions. They have all built up large and powerful industrial furnace organizations — and the recuperator has in every case served as the nucleus. It is no small recommendation for the recuperator when it can boast of such adherents and active participants in its exploitation, as the largest public utility company in America, and perhaps the greatest internationally-known corporation specializing in combustion equipment, among others.

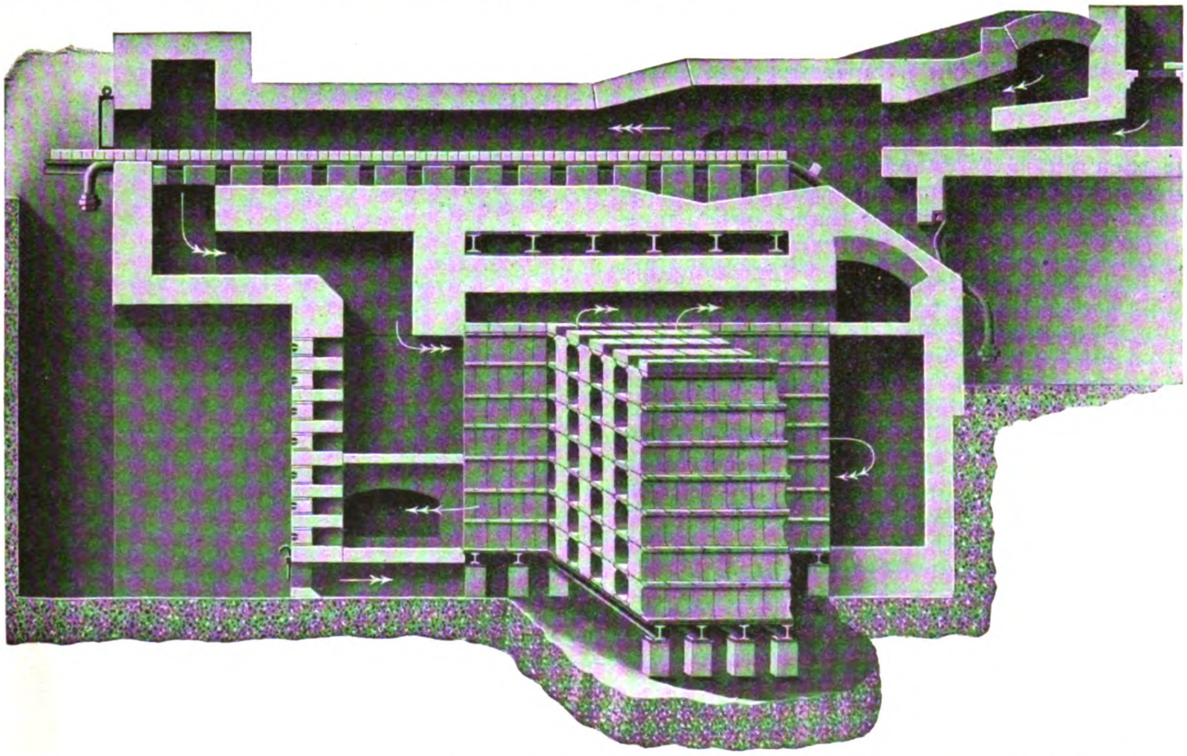
Field For Recuperation.

When such organizations can place their financial resources behind a proposition of this sort, it must be taken for granted that their investments have been prompted by good, sound business judgments and that the elements of chance and speculation are entirely lacking. They have convinced themselves that the recuperator has great commercial possibilities, and that it is destined to become an indispensable part of every industrial furnace. They see in the recuperator the key to a new and virgin industrial field of great fertility — one hitherto untouched. They know that the principles of recuperation are scientifically sound and thoroughly proven. They understand that it has a most unusually attractive sales appeal — one that can be easily understood, appreciated and visualized by the most untrained mind — for what is more obvious and impressive than the picture of dollars going up as smoke through a stack? They know that it constitutes the means for entering the lucrative field of industrial furnaces, a field whose immensity can only be comprehended when we consider that every piece of iron, steel, glass, brass and the innumerable other substances that are always about us, above us, beneath us, upon our very person—that the bridge, the typewriter, the door knob, the locomotive and the pin—that these and an infinite variety of other objects must all undergo some form of heat treatment and must all pass through some furnace at some stage in their manufacture. And they have learned that the furnace business is a big business.

They have discovered that the path of the recuperator leads into the very strongholds of industries that many furnace builders have hitherto found impenetrable — that it is the means of access to the steel industry with its forge, annealing, heat-treating, carburizing, sheet and pair, and innumerable other furnaces; to the glass industry with its pot furnaces, day and continuous tanks, and revolving pots; to the non-ferrous industry with its brass and aluminum melting, and copper and brass heat-treating furnaces; to the enameling industry with its kitchen-ware, flat-ware, and sanitary-ware furnaces; and even to the hitherto untouched ceramic, chemical, and cement industries.

With recuperation opening up a field of such alluring potentialities, it might appear strange that there are only four companies exploiting this device. This can be explained by the fact that the recuperator is an innovation here, having made its formal debut into industrial society hardly more than a year ago, as already stated. Every industry must have its pioneers, and these organizations are the pioneers of the American recuperative furnace industry. Their task has been a difficult one, starting in an unfriendly territory, and overcoming the obstacles of ignorance and prejudice in their missionary work. Whatever educational and development expense there was, has been borne by them.

They have convincingly demonstrated the recuperator to be a vitiating and stimulating impetus to the metallurgical and other fuel-consuming industries. The land is now clear, and the industries are in a receptive mood. The opportunity for the improved recuperator is here.



Phantom view of the continuous recuperative billet-heating furnace end discharge type as built by the Chapman-Stein Furnace Company

The POWER PLANT

Boiler Furnaces for Pulverized Coal

Discussion of a Paper by Professor A. G. Christie

By H. W. BROOKS[†]

BOTH Professor Christie and Professor Wohlenberg in their papers have stressed the importance of rapid mixing of gases in the furnace upon which speed of combustion and length of flame travel are dependent. Few engineers understand the extent of this mixing necessary.

The sieve opening in a 200-mesh screen (U. S. Series) is given as 74 u. (0.074 mm.). For convenience in calculation let us consider for the moment a pulverized coal particle consisting of a 70 micron cube. According to the Smithsonian Institution there are at 760 mm. and zero deg. C. in a cubic centimeter of any gas including air, 26 million billions of gas molecules, the oxygen atom having a radius of three-billionths of a centimeter. Dividing then the number of oxygen atoms per cubic centimeter by the number of 70 micron coal cubes per cubic centimeter we find that each average coal particle must split up into nine thousand three hundred billion carbon atoms and each must locate its corresponding oxygen molecule. Such figures obviously mean little to us. Let us, therefore, multiply the size so that we may better visualize the process. The air ship "Los Angeles" is 650 feet long, and has a total volume of 2,700,000 cubic feet. Let us consider then the carbon particle as a balloon the size of the air ship "Los Angeles." The comparative size of the oxygen atom would then be somewhat less than an .08-inch cube, or let us say about the size of a gnat.

Picture then the "Los Angeles," representing the coal particle, moving through the air either horizontally at a rate of somewhat less than a mile a minute or vertically at somewhat more than a mile a minute, carrying entrained along with it at approximately the same speed some twelve thousand billion gnats, representing the oxygen atoms. (For simplicity it is assumed that all air is introduced as primary air, including 30 per cent excess). Each of these gnat sized atoms in addition to their lineal speed are vibrating in fixed orbits at velocities many times the speed of a bullet, and measured in miles per second. Complete combustion necessitates our air-ship-sized coal particle disintegrating into some nine thousand three hundred billion pieces and combining with a corresponding number of the gnat-sized oxygen molecules.

In stoker firing with pieces of coal millions of times the size of our pulverized coal particle we aid the disintegration but little, leaving nature to take its course. In pulverizing coal, we assisted the natural processes somewhat by reducing the particle size before firing. We at least **began** to appreciate the huge task a piece of coal assumed in disintegration, though only in part did we aid the natural process of diffusion and atomic attraction which brought the carbon atom and the oxygen molecule together. Like Professor Christie and Professor Wohlenberg, many writers on combustion in the past have stressed the importance of turbulent flow, agitation and mixing to aid the natural diffusivity but a practcal means of accomplishing this mixing has heretofore remained undiscovered.

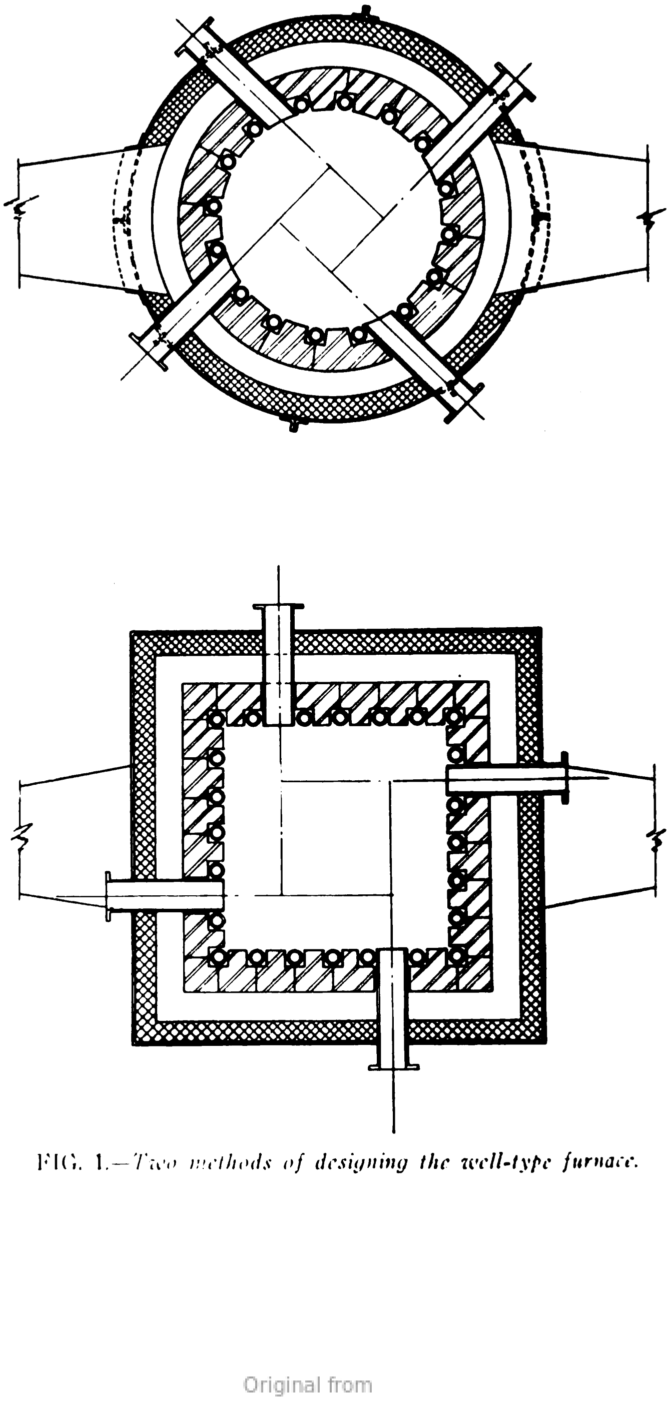


FIG. 1.—*Two methods of designing the well-type furnace.*

---

[*] Presented at the Pulverized Fuel Section of the Spring Meeting of the A. S. M. E., May 19, 1925.

[†] Consulting Engineer, Fuller-Lehigh Co., Fullerton, Pa.

Several years ago it occurred to one of the engineers of the Fuller-Lehigh Company that one of the most intense manifestations in Nature of turbulent flow and agitation of gases and particles in suspension was in the tornado, where it had been repeatedly demonstrated that materials of considerable tensile strength had actually been torn apart, disintegrated and reduced to fine pieces and sometimes to powder by the intense centrifugal action of the air. Experiments were started at Fullerton on a small furnace 18 inches square by 3 feet deep in which the jets were placed to throw the flame tangent to a tornado of fire within the furnace, the flame of the first jet being deflected before it reached the refractory walls by the impingement with equal velocity at right angles of the flame from the second jet, the third jet again changing the direction 90 degrees, and the fourth jet completing the tornado within the pot.

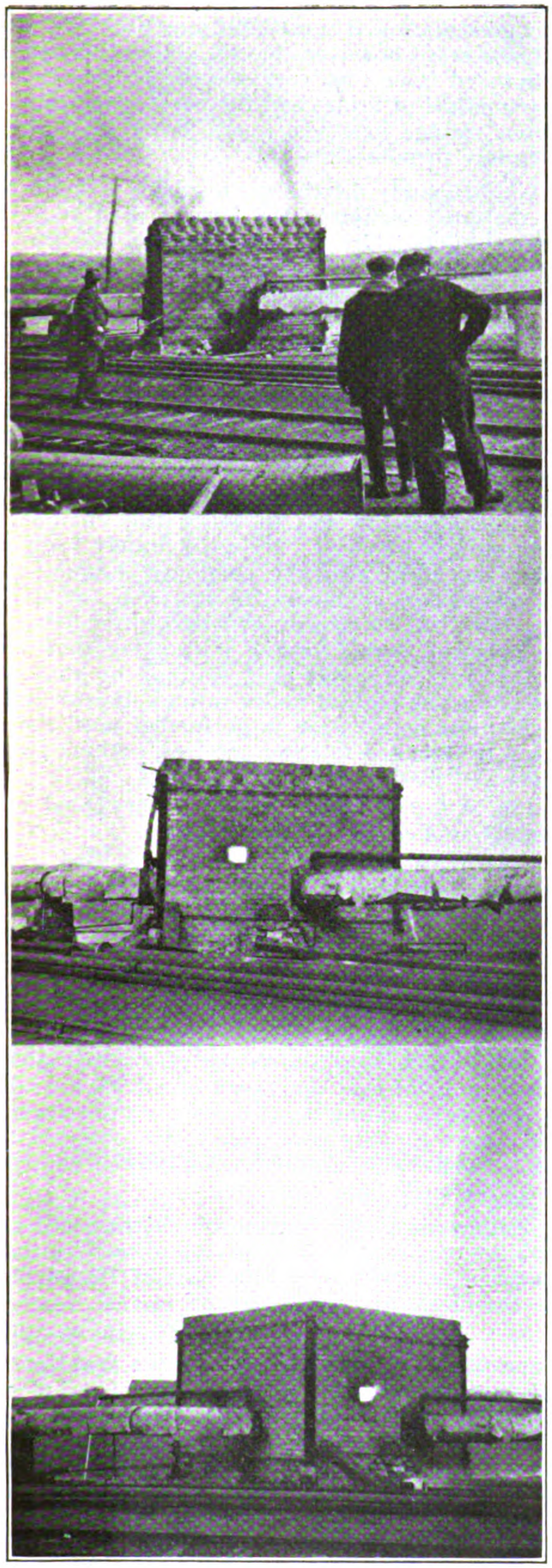


FIG. 2.—*Three excellent views of the experimental furnace at Fullerton.*

In order to give a clearer idea of the placing of these jets Fig. one shows in plan, the application both to the circular and the square pot furnaces.

It was well known that the external walls of the tornado of nature had been observed to be rather sharply defined from the surrounding air. Thus it was decided to adapt this principle by placing the pulverized fuel jets in such relation to the refractory walls that there was little, if any, impingement of the fuel tornado on the furnace walls. As was anticipated, therefore, the refractory walls showed little damage due to erosion, and thermocouple temperatures taken on the inner refractory surface of the furnace showed that the inner face of the brick never exceeded 2,700-2,900 deg. F.

It had also long been recognized that the transmission of sensible heat from hot furnace gases through boiler tubes to the water on the other side was limited by the existence at the boundary surface of a "dead film," generally assumed to be about 1/40 of an inch in thickness, of relatively cool gas in which convection currents apparently did not take place, and which owing to its low conductivity offered a high resistance to the passage of heat (other than radiant) through it. This "dead film" is the main and most potent obstacle to rapid heat transmission in a boiler, and it follows that it scomplete or even partial destruction will greatly assist the flow of heat and hence the efficiency of the boiler. Prof. J. T. Nicolson of the Manchester School of Technology, amplifying the fundamental research of Osborn Reynolds, demonstrated a fomula proving that heat transfer is a direct function of the velocity of gases passing the tubes. Thus it was anticipated and tests subsequently proved that with the higher scouring action of the swirling gases in meeting the boiler tubes that there would not only be a higher rate of heat transfer and higher boiler efficiency, but also a cleansing action which would keep the tubes clear of deposited ash.

Early during the experiments the nature of the ignition and combusion taking place in the well proved quite unlike anything experienced pulverized fuel engineers had hitherto seen in powdered coal combustion. The flame itself resembled that of a blow torch, virtually a "ball of fire," combustion apparently taking place in a limited zone within the well. By regulating air admission and air pressure it was possible to move the hottest zone into the well itself or to a point just in front of the well. Appreciating further the gains due to the more efficient transfer of heat by radiant energy as a result of this "ball of fire," the inventor had still further reason to expect efficiencies higher than had been before demonstrated in pulverized fuel combustion, as well as a flatter overall performance curve at high ratings.

These experiments were kept secret for several years, until finally a favored few of the larger operators were shown the experimental furnace at Fullerton. Several immediately volunteered to install a furnace of the new type, but the results which indicated heat releases many times greater per cubic foot of combustion volume than had ever been before accomplished were so revolutionary in character that the company felt it best to withhold a commercial scale installation until they had finally and thoroughly convinced themselves that no practical operating difficulties would intervene.

Finally on February 5, 1924, an agreement was entered into with the United Electric Light and Power Company of New York City by which a commercial scale experimental installation of the new furnace would be made at their Sherman Creek Station alongside five other boilers fired by the older pulverized fuel firing methods being exploited by various manufacturers. By thus conducting six simultaneous tests on six different systems under similar conditions the new furnace construction would not only be subjected to a large scale test, but at the same time could be directly compared with five competitive systems.

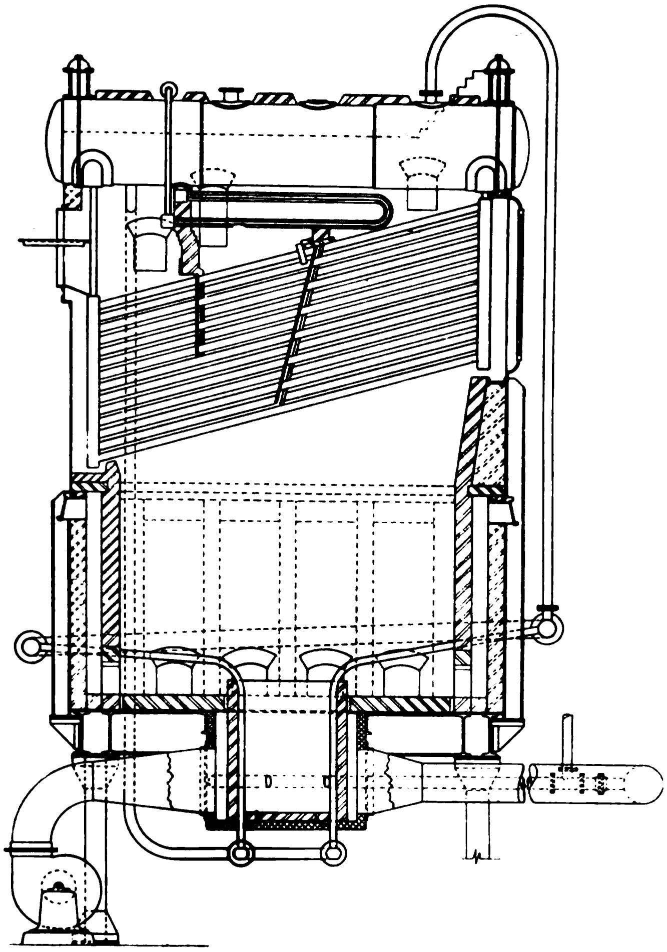


FIG. 3.—*A cross section showing dispersion chamber.*

It was particularly fortunate for the inventor that the operating company themselves expressed the desire to make the tests entirely with their own personnel. In this manner the natural enthusiasm of the creator could not inadvertently be injected into the testing technique and the results as obtained would be those of non-partisan observers, actuated entirely by a desire to seek for themselves the **Truth.** Today it is understood these tests have been completed. It had been our hope to be able to present them at this meeting. This having not proven convenient to the authorities of the United Electric Light and Power Company, we shall look forward to the privilege of their presentation at some later meeting. We are permitted to state, however, that the efficiencies have actually proved from 3 to 5 per cent higher than with any other method of firing, and the curve of efficiencies at various ratings has been much flatter than anything heretofore demonstrated.

Unfortunately there is not available a sketch showing the cross section of the furnace used at Sherman Creek. In its place Fig. 3 is shown indicating one of the more recent applications of this furnace. From the Fig. it will be noted that above the well there is provided a dispersion chamber in which the hot gases after burning are allowed to expand before reaching the boiler tubes, thus reducing the tornado effect to a value which can cause no possible erosive effect on the boiler tubes. The theory of this chamber was to allow just sufficient velocity to scour off the "dead film" without going any further in attacking the tubes themselves. It is not possible to state at this time the minimum size to which this chamber may eventually be reduced. It has definitely been established, however, that the combined volume of well and dispersion chamber can be made substantially less than the combustion space provided in the old-fashioned stoker setting. Knowing that we can convert present stoker-fired settings by this means, and attain the highest boiler ratings desired, we have at this time no occasion to go further until the application is extended to other services, such as transportation and marine.

Fig. 4 shows a plan of the water-cooled well as actually applied on the later designs.

Simultaneous with the tests at New York, research has been continued at Fullerton on a furnace consisting of an 8-foot cube.

Fig. two shows 3 views of this furnace.

One view shows the furnace just prior to ignition.

The top view shows the furnace immediately after ignition.

The bottom view shows the very remarkable phenomenon of the coal equivalent of a 1,500 hp. boiler at 632 per cent of rating being burned in the volume of an 8-ft. cube. Equally good results are obtained by the use of "wells" discharging horizontally as with the top discharge wells here illustrated.

Engineers of the Pittsburgh district will shortly have the opportunity of observing a "well" furnace installation in operation at the Brunot Island plant of the Duquesne Light Company.

It is felt that today the "well type" furnace is a demonstrated success and that for the first time in the history of pulverized coal the problem of turbulent flow and hence the problem of combustion volume has been solved. Not only may pulverized coal be efficiently burned in combustion volumes as small as those previously employed for stokers but actually smaller furnaces may be installed where necessary. For the first time, completely successful application of pulverized coal o industrial and metallurgical furnaces and to transportation and marine service becomes possible, as does also the conversion of present stoker-fired furnaces to the advantages of pulverized coal without the necessity in many cases of more than slightly modifying the present furnace construction. Thus many operators who have heretofore found the application of pulverized fuel impracticable on account of high cost of furnace re-construction have now made available to them the increased efficiency, economy, and flexibility of control of pulverized fuel firing.

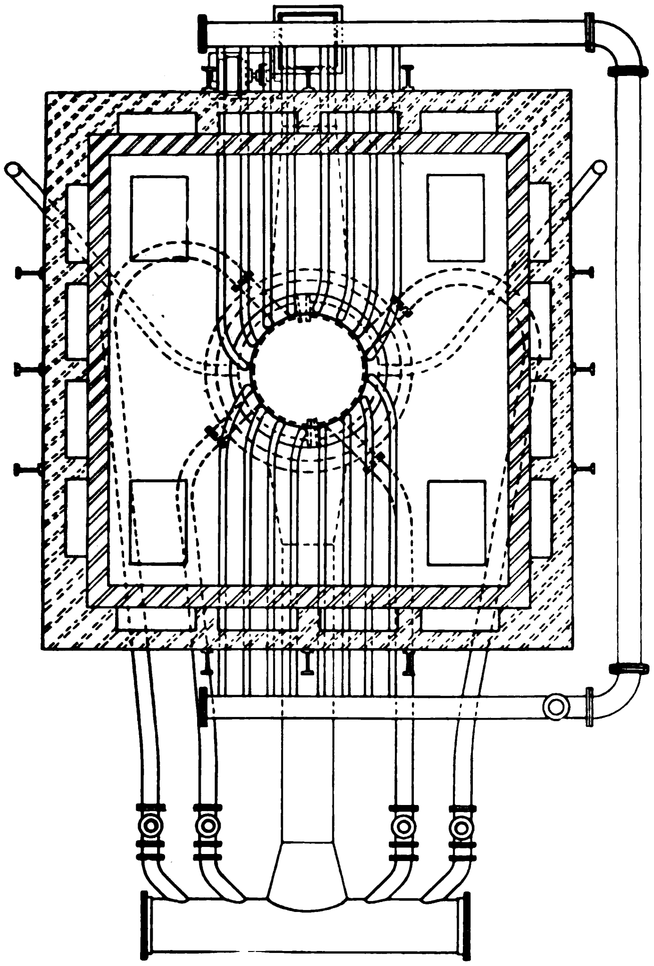


FIG. 4.—*Most recent plan of water-cooled well furnace.*

Thickness of Nickel Coatings

If nickel plating is used on exposed steel parts of automoibles and for similar work, the coating should be at least one-thousandth of an inch thick, according to the findings of the Bureau of Standards, Department of Commerce. If the film of nickel is thinner than this the finish will not be durable.

It has long been recognized that nickel plating as ordinarily applied does not yield satisfactory protection against the corrosion of iron and steel parts. An investigation of this subject by the Bureau of Standards has confirmed the work of others, and has shown that this failure to protect is due to the fact that the nickel coatings are almost invariably porous. It was not found possible to produce by any practicable method coatings which are entirely free from porosity. It was found, however, that if the nickel plating is made considerably thicker than is necessary or customary upon brass parts, the protective value can be very materially increased. It is believed that one one-thousandth of an inch is the minimum thickness that should be employed.

Breaking Rail Problem Discussed at World Railroad Congress

By A. C. Blackall*

To celebrate the centenary of the railroad in the land of its origin, the International Railroad Congress met this year in London. The increasing weight of rolling stock, the growing power of the locomotives employed, and the consequent greater proportion of high speed heavy traffic on railways combined to make the inquiry dealing with rails and the materials forming the track, and in which the question of safety may be involved, one of the greatest importance at the congress.

Four reports dealing with the breaking of rails, which at different times have assumed a serious aspect, were presented. One, by W. C. Cushing (Pennsylvania Railroad), dealt with American railways; another, by C. J. Brown (London & North Eastern Railway), contained reports concerning railways in the British Empire; a third, by Messrs. Merklen and Cambournac, discussed the subject from the French railroad standpoint; and rail breakages on railroads in other countries were the subject of a report by J. Willem (Belgian State Railway).

It was stated that in Great Britain the standard rail specification had been revised and was adopted by all railways. The section of rail for fast and heavy traffic on British lines ranges in weight from 90 lbs. to 100 lbs. per lineal yard. The average number of breakages per year is relatively very small, ranging on steam railways during the five years 1918 to 1923 from one in every 127 miles to one in every 450 miles of running track. On electric railways the average has risen in some cases, notably on the Underground Railways of London, to one in 38 track miles.

Many companies are now experimenting with special steels. The greater proportion of breakages occurs at, or in the close neighborhood of, the joint. In the United States, Mr. Cushing said, where very heavy rail sections have been used, it has been found that failures in 100-lb. rails are two and one-half times more numerous than failures in 130-lb. rails, but experiments indicate that the real remedy must be sought rather in an improvement in the quality and strength of the metal than by an increase in the weight of rail. This suggestion was concurred in by C. J. Brown, reporter for the British Empire, who emphasized the fact that a primary cause of fracture in rails is chemical or mechanical defects in the steel. There is no need, it was thought, to modify the specification, but rather to concentrate attention on the improvement of manufacturing methods.

The reports on French and other railways indicated similar experience to that on American and British lines. One point on which there was common agreement was the need of preventing rail breakages by giving particular attention to the careful maintenance of the track. The fact that so large a percentage of failures occur at the joint has led, the congress was told, to the preparation of reports on the methods which should be adopted to secure greater strength in what is admittedly the weakest part of the track. It was proposed that on all railroads tests of different types of steel rail joint should be carried out.

London, Eng.

SHEET AND TIN PLATE

Spalling of Sheet and Tin Plate Rolls

A Continuation of Many Years' Observations by a Practical Roller

By HAROLD HARRIS*

In an earlier issue, the question of certain troubles which come to every roller in the course of his day's work was opened up; rough surfaces on hard chilled rolls seemed the most important, so definite practical suggestions were offered which experience in Jones & Laughlin and similar great mills has shown will help.

Spalling is one of the bugbears which we can always look forward to and which we should always be prepared for.

In our July issue, we published Mr. Harris' discussion of the causes of roughness on hard chilled rolls. Considerable comment has resulted from this practical worker's open discussion of what to him is his most important problem.

In this chapter he takes up "Spalling," and offers suggestions toward its prevention.

We will welcome further comment by other practical men, whose close contact with sheet mill practice has given them the same or a different slant on the problem.

The spalling of a hard chilled sheet or tin-plate roll is caused by the water that is used to keep the rolls-necks cool, or which is used to control the temperature, or the working heat of the rolls; this temperature should be kept very close to 700 deg. F. to manufacture sheet-iron or tin-plate successfully.

Water seeps out of the top roll-necks on the inside of both housings on the roller's side of the mill. This water strikes the hot chilled working surface of the bottom roll on its face or body near the bearings or fillets on both ends of the rolls. Coming in contact with the heated roll surface, the lower temperature of the water causes crystallization of the chill in the roll surface.

In this crystaline state, cold pairs or sheets contacting with it during their passage through the mill, cause local fractures in the surface chill; small surface pieces work out, especially toward the outer edges of the bottom roll. This is known as spalling, which results in much lost time.

When this condition, sure to result in spalling, develops, the very best suggestion that can be made is, clean the hard hot neck grease from the top necks on the roller's side of the mill; do this even though it is necessary to take out the wooden side-blocks which are used to steady the top roll and hold it in position. After the grease has been thoroughly cleaned away, and the wooden blocks replaced, the water running on the top necks will fall directly through onto the center of the bottom roll necks, as it should, and will stop striking the hot surface of the bottom roll. Having eliminated the cause, spalling will stop. By carefully preventing any accumulation of hard grease, the water can take its proper course and place and these troubles will disappear.

Fig. 1.

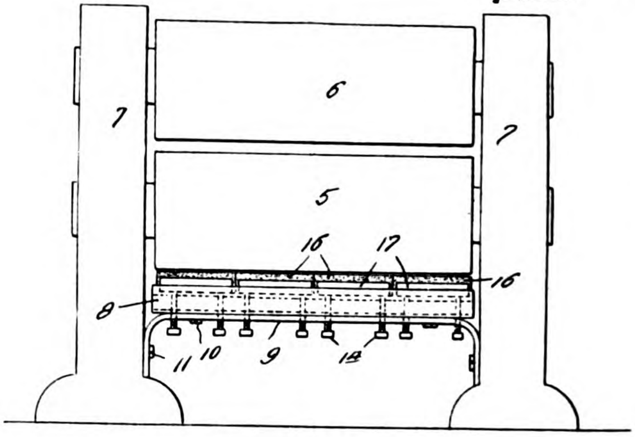
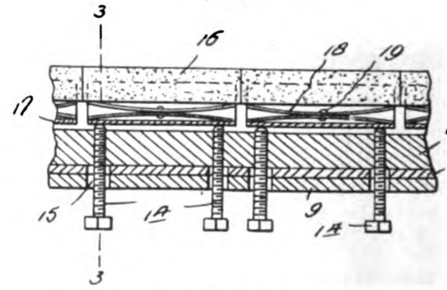


Fig. 2.



A method of polishing rolls.

It may even be advisable to saw a couple inches off the length of the side blocks before putting them in position; this allows more space between the collar or shoulder of the roll and the end of the side-block.

It is no unusual sight to see rolls which have been sent from the mill to the roll-shop, showing small fractures or surface breaks near the edges, these breaks ranging from one-half to one and one-half inches long. Inspection of the wobbler will usually discover the initial "B" on it; this indicates bottom roll. Sometimes 36-inch rolls require turning down to a 28-inch roll, which means a reduction in available roll surface corresponding to 25-inch wide orders.

---

*Woodlawn, Pa.

Spalling of Plate-Mill Rolls.

Plate-mill rolls have a heavier chilled surface than smaller sheet and tin rolls. Plate-mill rolling practice differs from sheet mill in that the mill is worked cold instead of hot.

Spalling of plate-mill rolls, which run from 40 inches to more than 140 inches, is often caused by the roller working, 10, 11 and 12-gauge steel too many passes through the rolls without using water on the chilled steel roll surfaces. The roller allows his rolls to become too hot on the surface in his efforts to get these light gauges through his mill quickly. Then he throws on the cold hydraulic pressure, and also keeps the pressure water on the last two passes of the hot plates; this practice of course finishes the steel with a red tank plate finish or color so desired by the customer.

The result, however, is exactly the same as in sheet-mill rolls. The sudden shock of cold pressure water thrown on the body of the rolls causes spalling of the surface, the chill falls out in heavy sections in many parts of the roll.

To avoid spalling, a plate-mill roller should carry water on the working surfaces of his rolls at all times.

Ore and Coal Bridges Made Safe

(Continued from page 326)

Stops do not interfere with rail splices or bolts.

Not necessary to grind or finish rails for W-S-M stops.

Stops applied at most suitable location on rails.

Rails d onot carry holding loads from one point on runway to another.

No danger of derailing wheels.

No parts such as ropes, solenoids or brakes.

No heavily stressed clamping levers liable to breakage.

No loads introduced into the bridge structure other than those already provided for.

Minimum of structural supporting parts required.

Small space required for stops.

Stops are applicable to nearly all types of bridges.

Minimum interference with removal of trucks.

Little likelihood of damage to stops in case of broken wheel or axle.

Cast Iron Pipe

For a century, pipes made of cast iron have been used more extensively than any other kind, in western Europe and America, for conveying and distributing water to communities. Pipes of this material, laid in trenches in the ground in 1665, still supply water to the fountains of Versailles. Philadelphia has cast iron pipes reported to have been in service for more than a hundred years. In many other communities also cast iron pipes have given good service for long periods. But like other objects of iron, pipes are the prey of corrosion.

Though cast iron pipe rusts on the surface, seldom pitting or scaling off, yet corrosion reduces the capacity of pipes for carrying water, sometimes forming rough lumps of rust, called tubercles, inside the pipe. Not only do the tubercles reduce the bore of the pipe, but they also cut down the water-carrying capacity by their roughness, acting as a friction brake on the flowing water. Tuberculation proceeds rapidly at certain stages and under certain special conditions of water. Sometimes these tubercles so nearly fill small pipes after a number of years, that but little water gets through.

Devices for scraping the rust from the insides of pipes have been mechanically successful, but it has been a common experience that some of the pipes tuberculate again in shorter time than they did originally.

It has long been known that cement, now so familiar in highway pavements, sidewalks, bridges, buildings, and water reservoirs, would inhibit tuberculation of iron embedded in it. Also, cement can be given a very smooth surface. Years ago water pipes were made of thin sheet iron lined and covered with cement motar. Pipes of this kind did good service for a period, but, owing to structural weaknesses, they have passed out of common use.

The problem resolved itself into getting a thin, smooth, strong coating of cement on to the inside of cast iron pipes of all sizes, and making the coating stick so tenaciously that it would withstand the hard bumps of transportation and of laying in the trench. The coating must cover every spot of the interior of the pipe.

The company built an experimental plant and undertook to make cement-lined cast iron pipe. At first, Rosendale, or "natural," cement was used, the coating being 3/16 inch thick in pipes 4 to 10 inches in diameter and ¼ inch thick in 12-inch to 24-inch pipes. Natural cement was preferred in the beginning because quicker setting and less subject to shrinkage and hair-like cracks. Each pipe (12 feet long) was stood on end with an iron cone, point up, at the bottom. Cement mortar in just the right condition was poured into the pipe around the cone. The cone was then drawn up out of the pipe, distributing the mortar into a thin, dense, smooth coating.

During 1922 and 1923, the process was much improved. Portland cement was substituted for the weaker natural cement. The pipe, open at both ends, is now placed, with its axis horizontal, on revolving rollers. A rich mixture of cement of proper consistency is distributed over the interior surface of the pipe while it is being revolved. After the cement is uniformly distributed, the pipe is rotated at a higher speed for about 25 seconds. These changes make possible a thinner, denser and more strongly adherent lining. Incidentally, it was discovered that the jarring vibration of the pipe as it was rapidly rotated drew some of the water in the mortar to its inner surface, thus making the inside of the pipe almost as smooth as porcelain.

Apparently this engineering investigation has yielded an acceptable solution of an old waterworks problem, increasing the durability and service value of cast iron pipe, and, above all, preventing loss of capacity through tuberculation.

Contributed by H. Y. Carson, Member, American Society of Civil Engineers; Research Engineer, American Cast Iron Pipe Company, Birmingham, Ala.

The Plant Laboratory and the Testing of Raw Material

By S. R. ROBINSON†

BACK in 1880 when Mr. Charles Schwab started in the steel business he worked under Capt. Bill Jones, then manager of the Braddock works of the Carnegie Steel Company. In those days the steel industry was in its infancy and chemistry had hardly been heard of around a steel mill. Mr. Schwab remarked that he recalled very well the first time the Pennsylvania Railroad specified a certain chemical composition for an order of rails. Capt. Bill Jones went up in the air at once, as he had never heard such names as carbon and mangenese. He remarked to Mr. Schwab, "Charlie, this damned chemistry is going to ruin the steel business yet." To prove that his prediction was not true I might mention that whereas this country produced less than 1,000,000 tons of steel in 1880, in the past year there were 43,000,000 tons of steel produced.

We are frequently urged to present practical talks and suggestions that will be helpful in the every-day problems which confront the industry. Mr. Robinson's remarks made before a gathering of his fellow workers are a frank discussion of the possibilities and the limitations of the chemist in the metal industry.

Practically all of this enormous tonnage is under chemical control from the iron ore, the coal and limestone, to the finished product. Every blast furnace has its laboratory and the custom of grading pig iron by fracture has gone in the discard.

Every heat of steel from an open-hearth furnace is sampled and an analysis furnished the melter before the heat is tapped. The melter became very expert at judging the percentage of carbon by the fracture of the test piece on open-hearth steel, but when he switched to electric steel his fracture readings were away off and he now depends on the laboratory entirely for his carbons.

The laboratory is often criticized when an error is made in an analysis, whereas if all the facts were known it is surprising how few mistakes are made that are serious. Take a carbon determination on a blow of steel weighing 4,000 pounds. A small test piece is taken weighing, say, one pound, drilled, and .2 of a grams is weighed out for the determination; now it takes approximately thirty grams to make an ounce. From this you can see how careful the chemist has to work and what an enormous chance for error there is.

It might be asked why there is such lack of uniformity in the metals at times with all this chemical control and the answer be that although much has been found out about the different metals there is still a lot to be found out yet. That the actual complete analysis does not tell the whole story and that in handling any of the metals there is some as yet intangible factor that is not under control. I suppose this is what makes the game so interesting.

In making analysis of the incoming material for the foundry there are certain well defined limits in composition that we work to. For example take the two grades of pig iron, foundry pig iron for the iron foundry, and steel pig iron for the steel foundry. In general appearance and shape these two materials may appear to us identically the same and we might well remark, "Why, there can't be much difference in these two kinds of pig iron. Pig iron is pig iron." "The chemist is drawing the line pretty fine when he says that a couple of pigs of foundry iron would ruin a blow of steel." The truth of the matter is there is a very good reason for the difference and it is in the amount of phosphorus in the two metals. Steel pig contains less than .04 per cent phosphorus while foundry pig contains as much as .7 per cent phosphorus at times, or 17½ times as much as the steel pig. So if we would accidentally get two pigs or 200 pounds of foundry iron into a blow of steel it would introduce as much phosphorus as 3,500 pounds of the steel pig.

The reason for keeping the phosphorus low in the steel is that in an amount of .1 per cent or more phosphorus makes the steel brittle and liable to break under shock.

The same element is in cast iron scrap and that is why we have to be careful not to introduce this material into our steel.

An analysis is made of the incoming coke to see that the maker supplies us with low sulphur and low ash and high fixed carbon in this material. The power house coal is tested, as is also fuel oil.

Foundry sands are tested chemically and a fineness test is also made.

On chemical control for the foundry we endeavor to make the necessary analysis with commercial accuracy and get the results to the foundry quickly. Manifestly it would be of no value tothem to know today that last week they kept within certain limits, whereas it is of considerable benefit to them to find out during the forenoon of one day the composition of the previous day's heat as a guide to today's operation.

On incoming material we endeavor to keep all stock up to specification such as alloy steel for studs and shafting, springs, bolts, cold rolled steel, staybolts, etc.

The problem of purchasing would be simplified if it were possible to give all incoming material some comparatively simple chemical or physical test and then get up a specification saying that the material will b eaccepted if it on analysis comes within certain limits, or if it meets certain physical tests.

---

*Presented before the Monday Noon Club, Industrial Works, Bay City, Mich.

†Metallurgist, Industrial Works, Bay City, Mich.

Digitized by Google Original from UNIVERSITY OF MICHIGAN

Unfortunately this is not possible in many cases. For example take high-speed steel—material of like analysis will give entirely different results when put into service. Here enters the personal element where in one case the maker has highly skilled men on the furnace and the hammers and his product has that so far intangible element that makes it a better product than the other producer who comes out with an inferior article, although they may both have the same analysis. Then it is necessary to go into an elaborate service test to prove which is the better.

This holds good on other materials, such as fire clay where the usual chemical analysis fails to tell the whole story, and we go to the fusion test, and even then if the clay is not finely ground it will not bond the individual grains of sand sufficiently to give good service.

This intangible something in materials and things we like to define as the soul or heart. We claim and rightly so that the industrial works' cranes have a soul, for there is a part of every one of us built into every one of them. I recall years ago at college that the professor of Anatomy was reported to have said jokingly that he had dissected many thousand "stiffs" or human bodies but had never found the place for the soul. However it is there and it is in this institution and in every institution which builds with its heart and hand.

It would be tiresome for you to listen to a detailed account of any analytical method that I might give. We try to locate the cause of a defect and not say, "Well, the analysis is all right, that lets us out." Oftimes the analysis is all right and still the piece is scrapped. We try to keep in mind that the analysis rarely ever tells the whole story. We try to obtain the whole history of the piece in question and give some reason for the defect so that it can be prevented the next time. Sometimes our explanation is not correct or is disputed by others, but if it has gotten them to thinking there is a better chance for the true cause to be located.

Every plant laboratory should do a certain amount of research work and keep up with new developments. Just now we are trying out a new pig iron in the foundry in the semi-steel. This pig is made from an ore mined in the north of Cuba—the ore contains Chromium and 1 per cent Nickel. These two elements impart valuable properties to steel and it is claimed by the makers that it will likewise impart valuable properties to steel and it is claimed by the makers that it will likewise impart valuable properties to cast iron.

This is another one of those intangible properties that we are trying to corner.

Not long ago the brass foundry made a heat of B-27 Brass that had the highest tensile strength and greatest elongation of any heat made so far in the foundry. The analyss was practically the same as any other heat, the melting, molding and pouring of this test bar was the same as hundreds of other bars. Other heats since have come close to this in physical results but none have reached it. Now the question is if it was done once why can't it be done every day?

We endeavor to keep a close watch on all heat treatments, and as is well known, every vanadium casting of major importance has a test bar attached and that bar must stand a certain test before the casting is released. In this connection we recently received a list of tests made on carbon vanadium steel forgings made by the Camden Forge Company. These forgings are for main connecting rods and it is recognized that when steel is worked under the hammer or press its properties are improved. However, averaging the total number of tests in this list and the results thus obtained as compared with our tests on cast carbon vanadium steel they show practically the same tensile strength and elastic limit and only 5 per cent better elongation and 10 per cent better reduction of area than we get.

We endeavor to co-operate with every department in correcting unsuitable material and also in testing out new material.

This last subject, New Material, which was so wisely passed on recently by the superintendent when he stated that he desired something definite on every kind of new material that came into the plant. I would ask those who are not clear on any new material they have tried out, to send a copy of their report to our department. In this way we will gradually collect data on articles which can be referred to in the future and thus eliminate a lot of retesting.

I imagine a great many of us have often asked this question: "Why is it not possible to conserve the heat that is in a newly poured steel casting by putting it in the heat treating furnace while it is still red hot, either reheat it, or allow it to cool slowly in the furnace?" If this could be done we would save fuel and time. When steel castings were first made they were left in the sand several days and were thus said to be "sand annealed."

Neither one of these treatments will produce the desired result, which is the **refinement of the grain** of the steel, thereby putting it in the best condition to stretch or give under load and to resist shock. It is true slow cooling in the sand or in the furnace will relieve strains in unequal sections but the main function of heat treatment is grain refinement as previously stated.

Last week in the foundry a Vanadium Slewing Pinion was shaken out hot and placed in the heat-treating furnace with a lot of miscellaneous Vanadium castings (the latter coming through in the regular way), and immediately heated and given the regular Vanadium treatment. After the charge had become cold on the following day, a test bar from the pinion was pulled along with bars from several other castings in the charge. The bar from the pinion had a coarse crystalline fracture and stretched only 5½ per cent, whereas all the other bars had a fine-grained fracture and stretched from **17½ per cent** to as high as **26½ per cent.**

The pinion on being broken showed the same coarse crystalline fracture. To prove that this fracture could be refined by proper heat treatment the end of the broken pinion with a test bar attached was again heat treated, after being allowed to become cold, and when the test bar was pulled it stretched **19½ per cent** and showed a fine silky fracture.

The lesson to us in this is that it is necessary to allow a piece of steel, whether it is a casting or a forging, **to become cold** before heat heat treatment to obtain proper grain refinement. Steel should be allowed to cool down through its lowest critical point before beng heat treated. This point is stated in all railroad specifications for forgings or castings, that is, the proper temperature to refine the grain."

WITH THE EQUIPMENT MANUFACTURERS

Two-Speed Synchronous Motor

A salient pole, synchronous motor which can be run at either of two speeds without changing the frequency of the power supply, has been developed by the General Electric Company. One of these machines has already been built, rated 5,000/2,500 horsepower, 600/300 r. p. m. for operation at unity power factor. Possible applications of such a motor would be in mine ventilation, ship propulsion and, when used as a generator, in hydroelectric generation of electricity.

The revolving poles of the two-speed motor are fitted with a special shoe of such form that each two adjacent poles can be excited with the same polarity. Thus the motor can be connected for either normal or one-half normal number of poles by throwing a pole-changing switch for the stator winding and a reversing switch for the field winding. Operated as a generator, this principle makes it possible to obtain two frequencies at the same speed or the same frequency at two different speeds.

In mine fan installations, where the full capacity of the fan is not required at times, and where a speed ratio of two-to-one is satisfactory, the two-speed synchronous motor has been proposed for use. By its use in ship propulsion half speed could be obtained at normal frequency, thus allowing the turbine to be operated at normal speed where the efficiency is maximum.

With connections reversed and operating as a generator, this machine has been proposed as a possible solution to the problem of hydroelectric plants where conditions are such that the effective head varies through a wide range such as in western irrigation projects, etc. At half turbine speed, a two-speed generator would give the same frequency as at normal speed, with reduced output but still with good efficiency.

Carnegie Steel Co. Water Purification System

Carnegie Steel Company has awarded a contract to Wm. B. Scaife & Sons Co., Pittsburgh, Pa., for a We-Fu-Go Intermittent Water Purification System, having a capacity of 2,500,000 gallons per day for their Farrell, Pa., works.

This plant will provide a water which will increase the steaming efficiency and lower the costs of steam production by eliminating the mechanical cleaning of boilers due to scale deposits and repairs due to corrosion. The water purified will not vary over eight parts to the million from a standard, even though the raw supply may vary in the quantity and kinds of impurities. The installation of this plant is in line with the most advanced policy of economy and efficiency by this company.

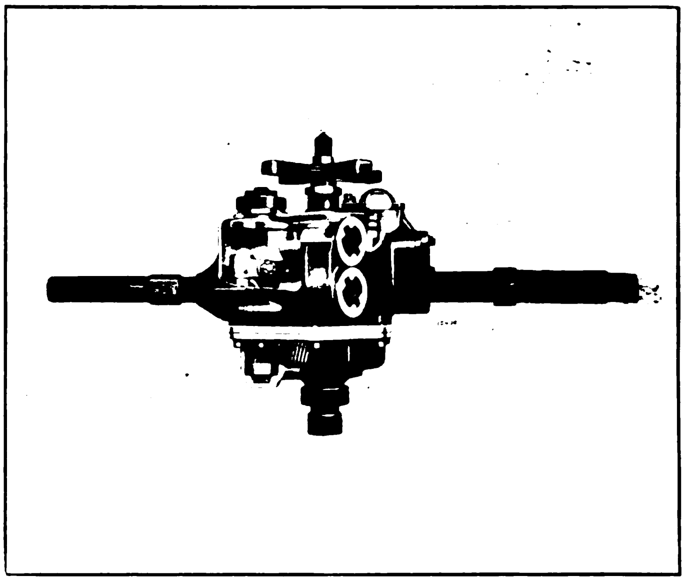
Carnegie Steel Company has also contracted with Wm. B. Scaife & Sons Co. for a similar plant for Lucy Furnaces, Pittsburgh, Pa., the supply to be purified being taken from the Allegheny River.

Four-Cylinder Drills with Governor

A new line of four-cylinder pneumatic drills, including both reversible and non-reversible sizes, has been placed on the market by Ingersoll-Rand Company.

These new machines contain many advanced features which all tend to give greater reliability, more efficient operation and reduced drill maintenance costs.

These are the only drills equipped with speed governors which automatically prevent racing the drills beyond a safe working speed. The governor saves on air consumption and prevents wear and tear on the drill parts. In tapping and reaming it avoids burning of taps and reamers.



Charles N. Ring Now Assistant Director

Charles N. Ring, until recently works manager of the Allied Steel Castings Co., Harvey, Ill., has been appointed as assistant director of the Electric Steel Founders' Research Group, succeeding W. J. Corbett, who recently resigned to become secretary-manager of the Steel Founders' Society of America.

Mr. Ring has had more than 15 years' experience in steel casting manufacture, following his education at Washington University and the University of Missouri. At various times, Mr. Ring was connected with the American Steel Foundries, the Commonwealth Steel Co., the Illinois Steel Co., the Laclede Steel Co., and the Ohio Steel Foundry, prior to his connection with the Allied Steel Casting Co.

Mr. Ring is active in affairs of the American Foundrymen's Association and the American Society for Testing Materials.

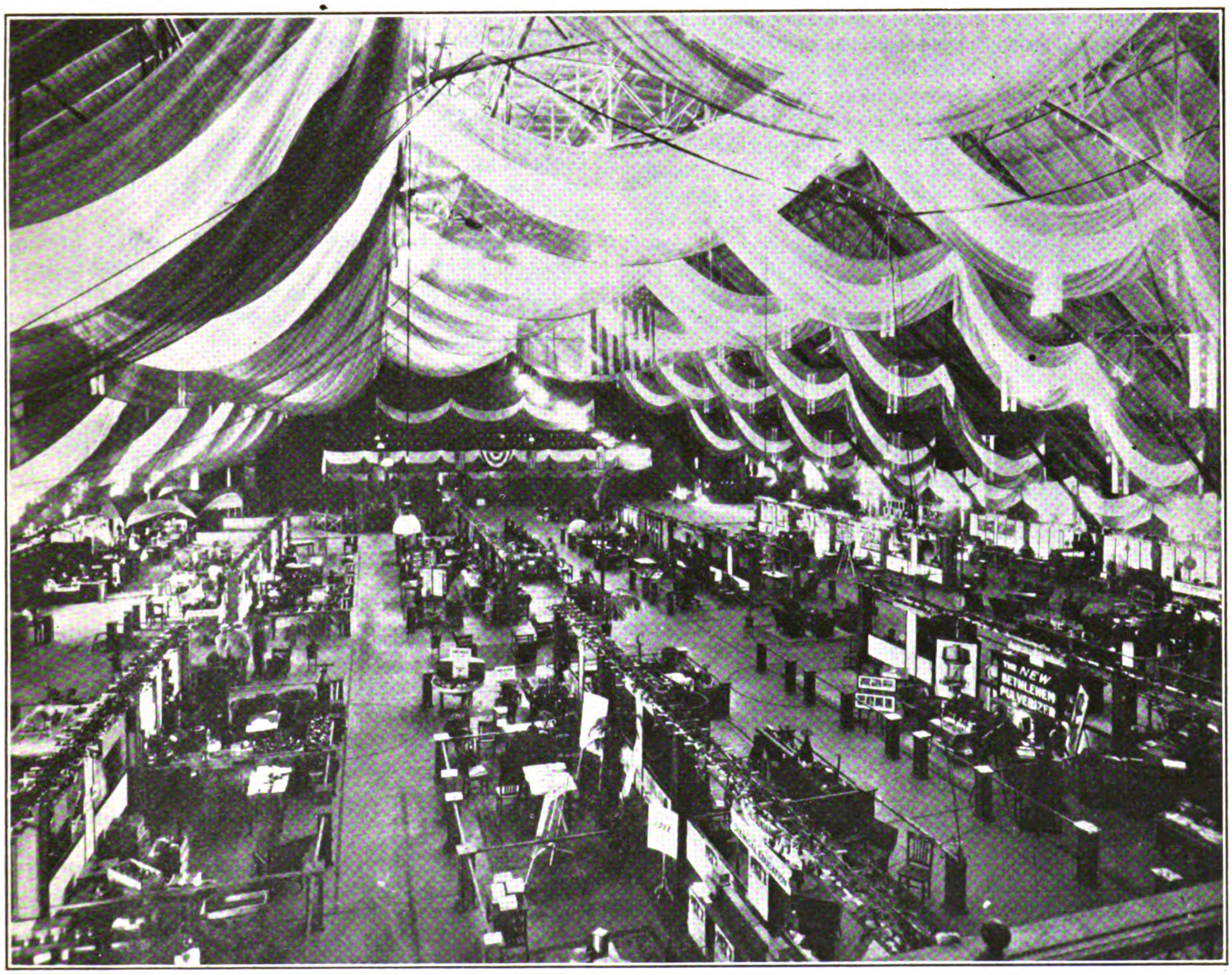
The director of the Electric Steel Founders' Research Group is R. A. Bull, and the companies of which the group is composed are: Fort Pitt Steel Casting Co., McKeesport, Pa.; Lebanon Steel Foundry, Lebanon, Pa.; Michigan Steel Casting Co., Detroit; Nugent Steel Casting Co., Chicago, and Sivyer Steel Casting Co., Milwaukee.

BY-PRODUCT AND CHEMICAL NEWS

Chemical Equipment Exposition A Success

Ten Hundred and Forty-three Technical and Industrial Visitors Register from 22 States and Abroad at Providence Show

WITH registered technical and industrial visitors' attendance of 1,043 from 22 states, Canada, Italy and Czechoslovakia and with a range of exhibits covering the entire field of essential processing equipment and materials, the first Chemical Equipment Exposition, promoted and managed by the Association of Chemical Equipment Manufacturers, opened in the State Armory, Providence, June 22nd, and came to a successful conclusion on Saturday, June 27th.



The exposition was held throughout the week in which the American Institute of Chemical Engineers held semi-annual four-day sessions in Providence. In conjunction with the exposition also occurred special sessions of a section of the American Chemical Society, the Providence Engineering Society and sections of the American Association of Textile Chemists and Colorists.

A feature of the week's events was the meeting in the Exposition building on Monday evening, June 22nd, of the Rhode Island section of the American Chemical Society and the Providence Engineering Society. Prior to an inspection by the members of the two organizations of the exposition, they were addressed by G. O. Carter, President of the Association of Chemical Equipment Manufacturers, on chemical equipment's application to Rhode Island industries.

A further feature of the week's events was a dinner of the Rhode Island and Northern New England sections of the American Association of Textile Chemists.

TRADE NOTES AND PUBLICATIONS

Robert Miller has been appointed manager of the Rocky Mountain sales district of the General Electric Company, succeeding Harry D. Randall, who is on leave of absence because of ill health. B. J. Wheatlake succeeds Mr. Miller as local office manager at Salt Lake City and Mr. Randall has been assigned to special duties at the general office of the company in Schenectady. Mr. Miller's headquarters will be in Denver.

The St. Louis County Gas Company is preparing to make improvements to its Webster Groves plant. Part of the additional apparatus installed will consist of two (2) Andale Aftercoolers together with the necessary connections, etc., required for them. In addition to the Andale Aftercoolers there will also be installed a Cottrell Electrical Tar Precipitation plant having capacity of approximately 6,000,000 cubic feet of gas per day. Contract for all of this work has been awarded to the U. G. I. Contracting Company of Philadelphia.

The Conveyors Corporation of America are distributing an illustrated booklet entitled "Ash and Soot Disposal." Many of the largest power plants in this country are euipped with American Steam Jet Ash Conveyors, and exterior and detail interior views of such installations are pictured. Operating results of four 800 H. P. W. T. boilers are specifically given. These sixteen pages will interest any progressive engineer.

Electric Hot-Plate

A unique application of an electric hot-plate for lowering the temperature of the working ends of open header dies and solid cold-forging tools is made at the plant of the Buffalo Bolt Company, North Tonawanda, N. Y., manufacturers of bolts, nuts, wire and bar material. At this plant, many tools and dies are made which must be specially heat treated in order to obtain production output on automatic and semi-automatic machines. In the case of header dies and solid cold-forging tools, it is essential that the body of the tool be of unusual hardness, it being necessary, at the same time, that the working ends themselves have less of the characteristic of hardness and more that of toughness.

The dies an dtools are first heated t oa temperature of 1,450 to 1,500 deg. F. in an electric furnace and then quenched in a saline solution. After cooling they are again heated, this time in an electrically heated oil tempering bath to a temperature of appromixately 450 deg. F. They are then allowed to cool to normal air temperature. Ordinarily, this cycle would constitute the complete heat treating process.

The tools and dies in question, however, are subject to great strains and shocks. In the case of carriage bolt open header dies, particularly, the square neck opening with its sharp corners constitutes a weak working part and, unless sufficient toughness is imparted to the metal at this point, the life of the die will be short.

Accordingly, in order to provide the proper element of toughness at the point where it is needed, without destroying the great hardness in the body of the dies and tools themselves, the Buffalo Bolt Company has installed an electric hot-plate, manufactured by the General Electric Company, for tempering the ends. The dimensions of the plate are approximately 9 x 18 inches and the electric heating element, suitably insulated, is cast in the plate itself, providing a suitably strong construction for withstanding the severe service imposed. The plate rests on a small, electrically welded frame about two feet in height.

After cooling from the oil tempering treatment, the working ends of the dies and tools are polished with emery cloth. They are then placed on the heated plate and left there until the ends assume a bluish color, indicating that the drawback operation has been completed. They are then removed and allowed to cool in the open air. The hardness of the working ends is thus reduced to give greater toughness and less brittleness, the original hardness of the tool and die body remaining. The operation is quickly performed and has been found to increase materially the life of the dies and tools in question.

The plate has been found to be simple and inexpensive, clean and safe, giving off no smoke, soot or fumes. The plate, oil tempering bath and electric furnace used in the operations described are all General Electric products.

Latest Stewart Bulletin

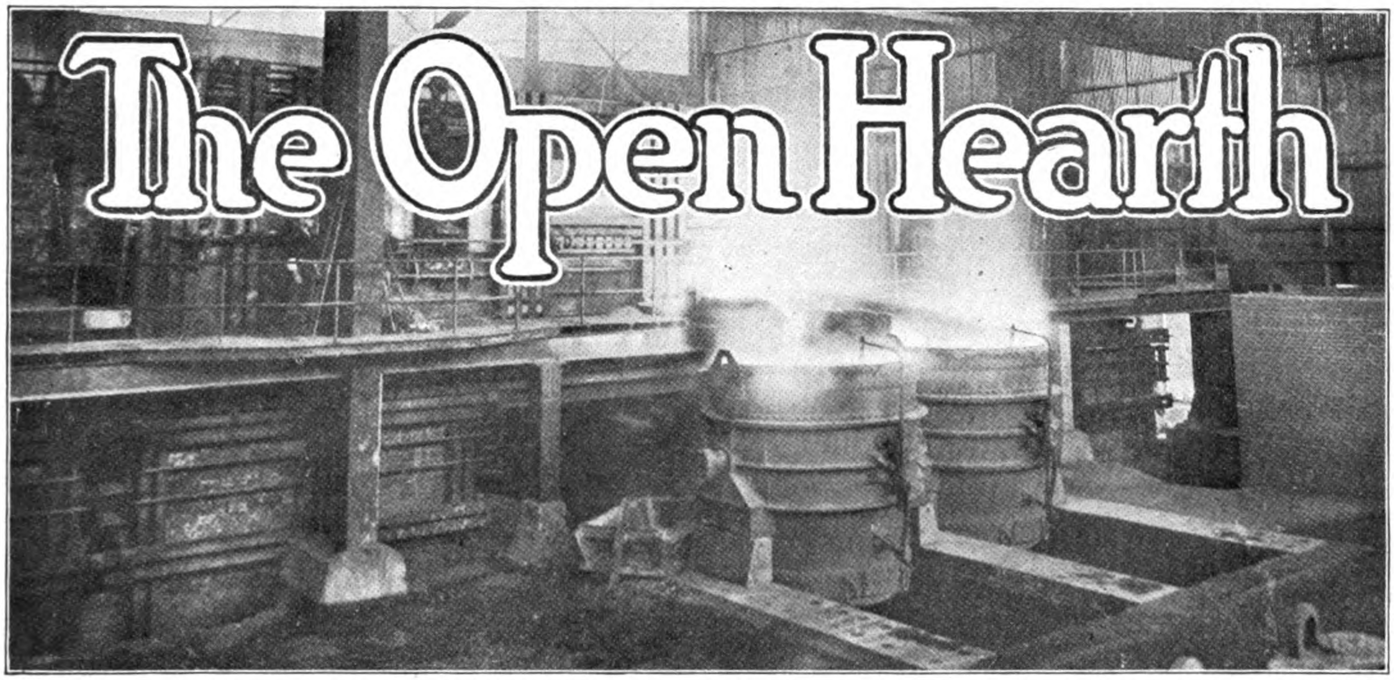
Performance, construction, service, satisfaction—are the watchwords emphasized in the new folder issued by the Chicago Flexible Shaft Co.

The Gray & Prior Machine Co., Worthington Pump and Machine Corp., and Fred Heinzleman have contributed testimonials to their favorable experiences with Stewart furnaces.

Sale of the two Schoenberger blast furnaces of the American Steel and Wire Co., at Pittsburgh, has been made to the Pennsylvania Railroad, according to a recent announcement. The furnaces and plant will be dismantled. These furnaces were built in 1865 and had an annual capacity of 164,000 tons. Neither has been active for several years.

Wanner Malleable Castings Co., Hammond, Ind., operating plants at Hammond, Ind., and Beloit, Wis., contemplates building air furnaces at its Beloit works. The new unit will require about 100 tons of steel and will have a stack about 150 feet high. The furnaces are expected to be put into operation in August or early in September.

Robert Bentley, Youngstown, Ohio, president Ohio Iron and Steel Company, and a director in the Youngstown Sheet and Tube Co., has been elected president of the Community Corporation. He succeeds as president Henry M. Garlick, identified for many years with the industrial development of the Mahoning Valley.



John F. Lewis, assistant general superintendent of the Edgar Thomson steel works, of the Carnegie Steel Company, at Braddock, one of the best-known steel men in the country, has retired after having been with the steel company for 52 years. For the last several years, Mr. Lewis has been in poor health and he decided to give up his position in an effort to regain his health.

Starting as a messenger and hammer-boy in 1875 under Capt. William R. Jones, one of the pioneer steel men in Braddock, Mr. Lewis worked his way through many positions until in 1896 he was appointed assistant master mechanic of the Edgar Thomson plant. In 1896 he was given the position of master mechanic and held that position until 1903 when he was appointed assistant general manager, at which position he worked for the last 22 years.

Fourteen years ago when the open-hearth blast turnaces were built at Braddock, Mr. Lewis had complete charge of the works and superintended their construction. He was the inventor of many machines now being used in the Carnegie Steel Company's furnaces, prominent among them being a vertical hydraulic ingot stripper, a blast furnace stock distributing device and a steel tie fastening device.

Mr. Charles S. Proudfoot has resigned his position of chief electrical engineer of the Cambria plant of the Bethlehem Steel Company to assume similar duties with the Vanadium Corporation of America. He will be located at Niagara Falls, N. Y.

Mr. W. E. Miller succeeds Mr. Proudfoot at Cambria.

Mr. Proudfoot's leaving and rejoining Mr. A. A. Corey recalls Mr. Corey's leaving Homestead, where he was general superintendent. When Mr. Corey was called to the vice presidency of Midvale, Proudfoot was one of the several superintendents who followed to assist in the reorganization work.

The Youngstown Sheet and Tube Company has appointed L. H. Underwood superintendent of blast furnace at the Indiana Harbor plant. Mr. Underwood had been superintendent of blast furnaces at the Gary, Ind., plant of the United States Steel Corp.

Brad. P. Wheeler has resigned as assistant to C. E. Korns, general superintendent of the Portsmouth, Ohio, works of the Wheeling Steel Corp. Mr. Wheeler has become associated with the Lackawanna works, Bethlehem Steel Corp., Lackawanna, N. Y.

Bureau of Mines Changes

H. H. Hill, chief petroleum engineer, has been placed in charge of the Petroleum Division of the Bureau of Mines, Department of Commerce, and will have supervision of all petroleum investigations conducted by the bureau both in the Washington, D. C., office and the various field stations and offices. Mr. Hill has served as assistant chief petroleum engineer for the past two years, and previous to this service was supervisor of oil and gas operations on leased public lands and superintendent of the Petroleum Experiment Station at Bartlesville, Oklahoma.

S. P. Kinney, assistant metallurgical chemist, with headquarters at Pittsburgh, Pa., has been designated as supervising metallurgist of the Bureau of Mines. Mr. Kinney will have technical supervision of the bureau's ferrous metallurgical work both at the Pittsburgh station and at the other experiment or field stations where ferrous metallurgical work is conducted. All members of the metallurgical staff of the bureau have been instructed to bring to Mr. Kinney's attention any matters pertaining to ferrous metallurgy which in their opinion may be of interest to the Bureau of Mines. Mr. Kinney has for some time been engaged in the study of problems affecting the technology of blast-furnace practice.

C. E. Sims, electrometallurgist, has been designated as chief of the metallurgical section at the Pittsburgh, Pa., experiment station of the Bureau of Mines, and in this capacity will have technical supervision of all metallurgical work conducted at that station.

E. D. Gardner, mining and explosives engineer, will, effective August 1, serve as acting superintendent of the Southwest Experiment Station of the Bureau of Mines, Tuscon, Arizon.

NEWS OF THE PLANTS

The Trumbull Steel Company, Warren, Ohio, has begun work on a new open-hearth furnace at its local mills, making a total of eight such units at the plant. The new furnace is expected to improve considerably the situation with regard to sufficient supply of material for the rolling mills, necessitating the purchase of steel from outside sources for some months past. It is expected to rush the furnace to completion and place in service at the earliest date. The estimated cost has not been announced. The company is also making improvements at its tin mills, including the installation of new heating furnaces and auxiliary equipment. Mixer cars and other kindred equipment are being installed for handling material from the blast furnace of the Trumbull-Cliffs Furnace Company, an affiliated organization, to the open-hearth furnace of the company on the other side of the Ohio River.

Plans are under way for a reorganization of the Empire Rolling Mill Company, Cleveland, Ohio, recently acquired by new interests, headed by A. W. Wheatley, Lima, Ohio. The new company will likely retain the same or closely similar name, and will be incorporated under state laws. Plant possession will take place in August, and tentative plans are being considered by the purchasing interests for alterations and betterments for increased efficiency; at the present time, it consists of six hot mills and two galvanizing pots. Mr. Wheatley is president of the Delphos Manufacturing Company, Lima, manufacturer of sheet and metal products, and it is expected that a large output of the Empire mills will be used by this company. D. R. James, heretofore secretary, treasurer and general manager of the Empire Company, will retire from the business.

The Coplan Steel Company, Ogdensburg, N. Y., is said to be arranging for the rebuilding of the portion of its local plant recently destroyed by fire with loss reported in excess of $40,000, including equipment. The rebuilding is expected to cost approximately a like amount. Headquarters of the company are at Hull, Que.

The Tampa Steel Products Corporation, Tampa, Fla., recently organized under state laws, has concluded negotiations for the purchase of a tract of about 2,000 acres of land at Sulphur Springs, near Tampa, as a site for a new plant, for which it is expected to have plans drawn at an early date. The initial works will consist of a number of buildings, with power plant, including three open-hearth furnaces, one 20-inch mill and one 8-inch mill, with auxiliary structures. The esimated cost is reported in excess of $500,000. The new company is said to be headed by J. R. Finkelstein, formerly head of the Hoosier Rolling Mill Company, Terre Haute, Ind. The Tampa Industrial Development Corporation, Tampa, F. H. Wolfe, president, is interested in the project.

The Falls Steel Tube and Manufacturing Company, Newton Falls, Ohio, lately organized under state laws, has acquired a tract of about three acres of land on the line of the Baltimore & Ohio Railroad, vicinity of the plant of the Newton Steel Company, and is perfecting plans for the erection of a new mill for the production of steel tubing and affiliated products, including steel pipe up to 3½ inches in diameter. The works will comprize a main unit and several minor structures, reported to cost more than $250,000, with equipment. It is expected to make machinery purchases at an early date, having the plant ready for service in the fall. The company is headed by R. A. Kenworthy, recently resigned as secretary and treasurer of the Newton Steel Company, who will act as president and treasurer; George T. Filius, Warren, Ohio, has been elected vice president and secretary of the new company.

The Parkersburg Iron and Steel Company, Parkersburg, W. Va., has purchased a tract of local property, totaling about 12 acres, and has plans under way for the construction of a new plant, consisting of a number of one-story units, to cost in excess of $100,000. The initial plant will be extended at a later date. It will be given over to the production of a line of steel and iron products, including pipe, bends, etc.

The Pacific Rolling Mill Company, Inc., Seventeenth and Mississippi streets, San Francisco, Cal., has purchased a tract of land at Kansas and Marin streets, totaling close to four acres, and plans for the erection of additions on the site. The project will include a one-story farbicating shop and one-story foundry for steel casting production, estimated to cost close to $600,000, with equipment. It is purposed to install machinery to develop an output of 2,000 tons per month, as compared with a production of approximately one-half this amount at the present mills. It is expected to proceed with the work at an early date. E. B. Noble is president, and A. E. Wilkins, general manager.

The Donner Steel Company, Buffalo, N. Y., has work in progress on the electrification of its local mill at 475 Abbott road, to include the installation of motors, controls and accessory equipment. It is purposed to replace practically all steam-driven apparatus. Frank R. Huston is vice-president and general manager.

The Millard F. Wilfong Iron Works Company, Philadelphia, Pa., has plans for the immediate rebuilding of the portion of its local iron and steel plant at Fifty-second street and Grays Ferry avenue, recently destroyed by fire with heavy loss, an official estimate of which has not been announced. Considerable new equipment will be installed, including traveling cranes and other material-handling apparatus.

The Youngstown Sheet and Tube Company, Youngstown, Ohio, has authorized plans for the construction of its proposed new battery of tin mills at its plant at Indiana Harbor, Ind. The work will consist of 224 individual mill units, estimated to cost more than $2,000,000, with machinery. It is expected to begin actual erection in the near future, when contracts for equipment will be placed. James A. Campbell is president.

Digitized by Google Original from UNIVERSITY OF MICHIGAN

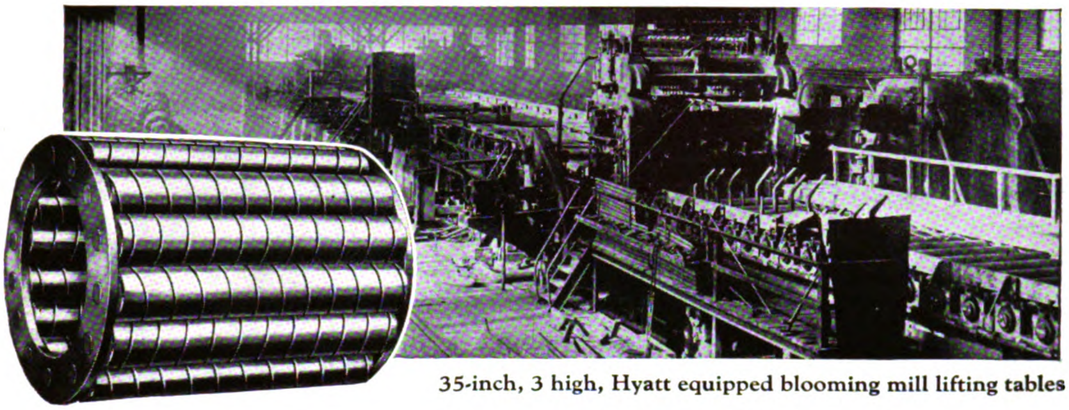
AUG 12 1925

The Blast Furnace and Steel Plant

Member of the Audit Bureau of Circulations

PITTSBURGH, PA., AUGUST, 1925

Entered as second class mail matter at Pittsburgh, Pa., under the act of Congress, March 3, 1879.



35-inch, 3 high, Hyatt equipped blooming mill lifting tables

Giants for Performance

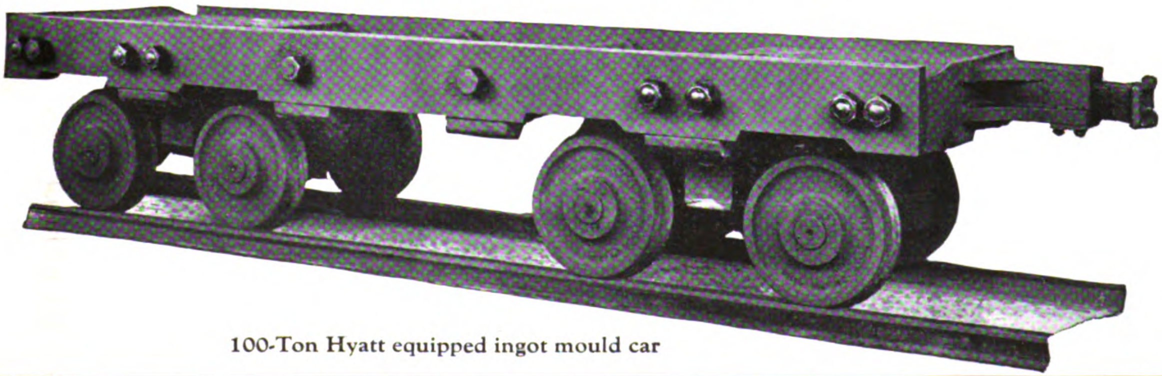
HYATT steel mill bearings are giants for strength and endurance. Their rolling action, positive lubrication and ability to absorb shock loads fit them for the severe requirements of steel mill service.

In charging cars, ingot mould cars, rolling mill tables and other types of equipment Hyatt bearings have, by years of creditable service, proved their ability to stand the gaff. By eliminating plain bearing friction they speed up work, permit uninterrupted operation increase production and lower costs.

Leading plants are using these bearings with complete satisfaction and are continually adding to their Hyatt bearing equipment.

Investigate the advantages that Hyatt bearings can bring to your mill. Our engineers are glad to furnish full information on bearings for your new or present equipment.

HYATT ROLLER BEARING COMPANY
NEWARK DETROIT CHICAGO SAN FRANCISCO
WORCESTER PHILADELPHIA CHARLOTTE
PITTSBURGH CLEVELAND



100-Ton Hyatt equipped ingot mould car